diaphragms. There were no symptoms referable to the appearance. On investigation they found she had worked for three years handling and helping in printing of cigarette packages on which there was considerable bronze work. The material was used in liquid form and was frequently spilled and dried, leaving a fine dust. After a day's work she could taste metal and her sputum was said to be brownish. We are familiar with this case and can vouch for the above statements.

In connection with metal industries we have examined a few stove plate moulders and foundry men whose lungs have showed well-marked second stage changes after a number of years' occupation. We have regarded the appearances as most likely due to sand.

BRICK WORKERS

The constituents of brick are suitable for the production of pneumoconiosis. Clays contain hydrated aluminum silicate with more or less sand or free silica and a few other ingredients. Sand is a necessary constituent of brick clays and may constitute quite a high percentage. Fire brick mixtures usually contain more sand than the clay for building bricks, and the constituents are often mixed dry.

Middleton[33] reported silicosis in 18 silica brick makers. Purdy[41] quotes Collis[40] as stating that almost pure silica occupations like silica brick making have a high mortality from tuberculosis, while with workers in mixtures of silica and clay as used in ordinary bricks, the mortality is very low. We have had no personal experience with pneumoconiosis in brick workers. One man who had worked continuously as a brick maker for forty years was recently examined by us and no changes of a silicotic nature were found in the lungs. On the other hand, we have been told by other brick workers that many of their companions who had worked in the industry for a long time were obliged to stop because of lung troubles. We have been informed of one individual whose occupation was the replacement of fire brick in a steel mill furnace and who showed clinical evidence of advanced pulmonary fibrosis after many years of such occupation. The dust was always very dense and he had worked longer at the job than any other man he knew, all the others having been obliged to stop because of lung troubles.

CEMENT WORKERS

Anyone who has seen a cement factory in operation knows that it is one of the most dusty of all places, and yet the industry cannot be regarded as a hazardous one from the standpoint of pneumoconiosis. There are several distinct occupations in this industry, especially those of coal handling, rock grinding, cement grinding and the packing and handling of the finished product. With Miller and Landis[1] we examined 20 cement workers several years ago. Five of these showed possible first stage changes and the other 15 definite second stage appearances. The earliest second stage changes were found in a packer after seven years' occupation and were slight only. Of the men longest at work, a cement grinder showed slight second stage nodulation after eighteen years and a kiln room man presented very definite nodules after nineteen years. All occupations showed some changes. One would expect the greatest effect among the rock grinders, although the rock contains but a comparatively small percentage of free silica. We cannot, of course, tell what changes might have been found had any of the men been working thirty or forty years. The second stage appearances were variable, some of the nodular shadows being small and discrete and others "soft" and comparatively large.

ASBESTOS WORKERS

This is another very dusty industry. Asbestos is a magnesium silicate, and the rock that is crushed contains more or less free silica, to which the workers may be exposed all the way through the process of manufacture to the finished product. Cook[49] describes asbestos as a calcium and magnesium silicate, with 40 per cent of free silica among other constituents. This percentage no doubt varies in different localities. Cook reported one asbestos worker who died of a pulmonary condition

after twenty years' occupation. The roentgenograms showed extensive pulmonary fibrosis. Macroscopically the lungs were densely fibrosed and showed caseation and cavities, and microscopically tubercle bacilli were found in caseated areas. From our own experience we would regard this as largely a tuberculous case.

With Miller and Landis[1] we examined 17 asbestos workers, 2 of whom showed first stage changes and the other 15 definite second stage appearances. Of the men longest at work, one after seventeen years' occupation showed very definite diffuse, "soft" spots throughout both lungs, and another showed about the same appearance after fourteen years' occupation. Very slight nodular shadows were found in one man after only two years' occupation. Most of these second stage cases showed also well-marked first stage appearances still present, indicating a persistence of free drainage hilumward. In all instances the nodular shadows were characteristically "soft" and varied considerably in size.

CARBORUNDUM

We have been unable to obtain any definite information in regard to the condition of the lungs of carborundum workers. Holmes,[66] who investigated the industry at Niagara Falls, N. Y., regarded the dust as injurious to the lungs, and the reason why workers were not affected to any great extent was because of the labor turnover. Few laborers remained at work sufficiently long to acquire serious damage. He described the entire industry as exceedingly dusty and a dust analysis showed that the number of small particles were far beyond a safe limit. The shaving rooms where the abrasive wheels were cut down before going to the baking kilns showed the greatest hazards.

Gardner[22] described the carborundum plants as very dusty, and 75 per cent of the particles were 1.5 microns or less in size and therefore suitable for cellular disposition. By animal experimentation he found that carborundum dust reached the tracheobronchial lymph nodes and did produce fibrosis there. He was unable to find a true fibrosis in the lung parenchyma, but if extensive inhalation tuberculosis was developing, a decided pulmonary fibrosis resulted. He concluded that carborundum dust was harmless to the normal lung.

In the manufacture of carborundum, a mixture of sand and coke is fused in an electric furnace. The resulting product is a crystalline and amorphous silicon carbide (SiC) which is said to be silica free. After leaving the furnace the crude product is crushed and ground. In making abrasive wheels and stones the particles are held together by some substance like porcelain, then shaved or cut down and fired in a kiln. The substance holding the carborundum particles together is likely to contain silica, which may be set free when the wheels or stones are used for abrasive purposes.

LIME DUST

Nicholson[50] states that the inhalation of lime dust in the Derbyshire region does not produce any extensive lung fibrosis. It is soluble in the body fluids. Roentgenograms showed a diffuse mild fibrosis probably due to a small amount of free silica present. Purdy[41] in his review of the literature on silicosis found that dusts like plaster of Paris and lime stone were regarded as devoid of all harmful action on the lungs. We have had no experience in the examination of lime stone workers.

MISCELLANEOUS INORGANIC DUSTS

We found second stage appearances in one charcoal burner of many years' occupation, but the exciting factor in this individual is unknown.

One flint grinder in a sand paper works showed advanced third stage changes after ten years' occupation (Fig. 4).

One worker in a plaster works showed third stage fibrosis.

One man who had worked in a wallpaper factory running a wallpaper machine for six years showed second stage appearances.

We have been informed that pneumoconiosis has been observed among jute workers, and also in cotton mill workers, especially those who open the bales. No doubt there is a certain amount of free

silica in the dust to which these individuals are exposed.

There are undoubtedly a large number of other industries in which the workers are exposed to silica and other dusts capable of producing pneumoconiosis. When one considers that even the farmer in sandy soils may develop a mild silicosis, the number of industries exposing the workers to pneumoconiosis producing dusts must be almost endless.

ORGANIC DUSTS

In 1917, we examined for Miller and Landis,[1] in connection with the occupational clinic of the University of Pennsylvania, the chests of 9 wood workers, 19 textile workers and 13 tobacco workers.

According to our experience, wood working is not likely to produce any very marked lung changes, even after a long period of time, unless sand is used. Hard woods do contain inorganic substances, and most of the men examined were workers in hard woods. One individual showed very evident first stage appearances after an occupation of forty years without sand. Another showed third stage changes after twenty-two years with the use of sand. The two oldest workers, fifty-four and fifty-six years respectively, showed definite second stage appearances. Both were sanders for at least a part of their time at work. Usually the second stage mottling was small and "soft." Pincherle[51] examined 20 wood workers, of whom 14 showed morbid changes in the respiratory tract, 7 bronchial catarrh and 7 had asthmatic attacks.

Of the 19 textile workers, 9 showed possible first stage changes and 10 definite second stage nodular shadows, with characteristic small, "soft" spots. In the latter group the first stage appearances were still in evidence, and frequently more marked on the left side than the right, the reverse of the early second stage appearances. This might be expected, however. Only 2 of the second stage men showed very marked nodular fibrosis, and they had worked eleven and thirty years respectively. The oldest was forty years at work and showed slight but definite changes. One individual of forty-two years' occupation showed doubtful first stage appearances. Landis[43] in commenting on these individuals, states that organic dusts, notably those to which carpet weavers were exposed, and in whom some changes were noted in their lungs, showed by analysis a large amount of inorganic material which was probably responsible for the lung changes. He examined the autopsy protocols of 50 textile workers who had died in three hospitals in Philadelphia and found that while 4 had died of tuberculosis and 4 of pneumonia, there were no recorded respiratory tract diseases as the cause of death in the remaining number.

Of the 13 tobacco workers who were examined, only 3 showed any changes that could be construed as suggestive of even the first stage. Palitzsch[52] reported a case of a chronic pulmonary affection supposed to be pneumoconiosis caused by inhaling the fine powder from a cigarette grinder. Tuberculosis was excluded.

In further commenting on organic dusts, Landis[43] states that organic dust, *per se*, never produces pneumoconiosis, although some may cause asthma and other conditions due to direct irritation.

In connection with the subject of pneumoconiosis, brief reference may be in order to the roentgenologic appearances of lungs following exposure to irritating gases. We had occasion to examine a few cases for the Occupational Clinic during the war. We found that usually the trunk shadows were more pronounced and sometimes the linear markings became prominent. In a few instances the hilum shadows seemed to be increased in extent and prominence. Gases will not produce nodular fibrosis. In interpreting first stage changes in suspected pneumoconiosis, which is frequently a doubtful interpretation, one must be sure to eliminate the possibility of the appearances being due to other irritants than dust.

In conclusion, we have attempted to review the entire subject of pneumoconiosis from the pathological and roentgenological standpoints, to place our own group of cases on record, and to urge the more wide-spread study of dusty industries

by roentgenologic investigations with a view of lessening the dangers to which many workers are exposed.

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THE EFFECT OF EFFORT ON THE SIZE OF THE HEART

OBSERVATIONS ON ANIMALS AND MARATHON RUNNERS*

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A CRITICAL controversy has developed during recent years among those interested in the effect of effort on the size of the heart. This is due to certain clinical observations which have pointed to an actual hypertrophy following prolonged athletic training and a dilatation of the heart occurring immediately after strenuous effort. There are also numerous pathological reports on the hearts of animals subjected to various forms of exercise. Here the impression has been that hypertrophy develops after long periods of strenuous work and that dilatation may occur following acute overexertion. In similar anatomical studies on man, however, there is less agreement on the relationship between exercise and heart size.

It is not the purpose of this paper to review the literature which is outlined by Bainbridge,[1] Williamson,[2] Pratt[3] and others, nor to discuss the various aspects of this problem, but rather to give in a general way the observations on heart size made on animals[4] and Marathon runners[5] at the Peter Bent Brigham Hospital during the past three years. It was the intention for the study to reconcile, if possible, the conflicting views of previous observers by determining through roentgenographic examination whether or not acute dilatation occurred in the normal or abnormal heart following strenuous effort. The question of a permanent enlargement of the heart was also considered in this investigation. The roentgenogram was selected for making the observations because it offered the most helpful means for quickly and accurately measuring the transverse diameter of the heart and providing a permanent record for future reference. This seemed preferable to such physical methods as palpation and percussion because it eliminated to a considerable extent the difficulties of examining the nervous and, oftentimes uncooperative participants before or after the athletic contest. It also removed the possibility of error, which often arises during the examination of individuals with well-developed chest walls and those with emphysema. Such difficulties, commonly experienced in applying the physical methods, were no doubt encountered in former studies and may be largely responsible for the wide difference of opinion existing today about the size of the heart following exercise. The orthodiagraph, although previously employed and generally considered of great value, was not used in this study because of the limited time at disposal for each examination and the possibility that error might occur due to the personal equation. The roentgenogram was also selected for the animal studies because it was apparently the only satisfactory means for obtaining a record of heart size without anatomical examination.

The plan for study was as follows: Roentgenograms were made of a group of normal adult rabbits and a number of other rabbits with chronic myocarditis and hypertrophy which had been produced by spartein sulphate. The animals were then exercised in a treadmill until exhaustion developed, as evidenced by limpness, cyanosis and marked dyspnea. The rabbits were then removed from the treadmill and the roentgenograms were repeated without delay. In a few cases successive roentgenograms were made at intervals during the recovery of the animals. In estimating the changes in heart size, silhouettes were traced on paper from the heart shadows and weighed in milligrams; comparisons were then made between those obtained before and after exercise.

It was found that all of the rabbits, including those with chronic myocarditis showed a definite diminution in the size of the heart immediately following effort. The average decrease of all cases was about 19 per cent. Following exercise the rabbit

* From the Medical Clinic of the Peter Bent Brigham Hospital; read at the Twenty-sixth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Washington, D. C., Sept. 22–25, 1925.

itself made a surprisingly quick recovery and although it required about two hours for the heart to return to normal size the animal was symptomatically quite normal within fifteen minutes. It is striking to note that no dilatation of the heart occurred following acute overexertion and there was no evidence that the general condition of the animals was influenced by the strenuous effort. This was true in those rabbits with marked cardiac enlargement as well as in the normal animals.

The American Marathon race which takes place annually in Boston on April 19 offered another opportunity to study the effect of effort on heart size. In the race of 1923 a number of the most experienced long distance runners in the United States and Canada competed. It was an opportunity to study not only the effect of a single strenuous prolonged effort, but also the effect of prolonged vigorous training on heart size. Through the cooperation of the Boston Athletic Association the roentgen-ray apparatus was installed in the club rooms near the finish line. It was possible by assisting the runners to the apparatus and supporting them during the examination to take the roentgenograms within two or three minutes after the runner completed the race. Successive pictures were also made after the competitors had rested for one or two hours. In estimating the change in the heart size the measurements of the transverse diameter of the hearts obtained either before or several hours or days after the race were compared with those obtained at the finish. To prevent error in calculation due consideration was given the position of the diaphragm, the transverse diameter of the chest, and in those instances where there were differences of position, or distortion, the films were discarded.

It was found that immediately after the race all the hearts were small. This indicates that a strenuous prolonged effort does not cause acute dilatation of the heart. Successive roentgenograms taken during the course of one day showed merely a gradual return to normal. The hearts were also studied for evidence of hypertrophy by dividing the transverse diameter of the heart by the transverse diameter of the chest. According to this so-called cardiothoracic ratio[6] there was no enlargement present, the largest hearts being definitely within normal limits.

During the past twenty-four months a group of these runners who had been competing frequently in long distance races and training for several months each year have been examined by the roentgen ray for any permanent change in heart size. In this study no enlargement of the heart has been noted, which means, so far as it is possible to judge by using the present method of study, that many years of the most vigorous physical effort did not produce cardiac hypertrophy.

The objection may be raised, and quite fairly so, that simple hypertrophy of the myocardium, or so-called concentric hypertrophy, may have been present without being recognized by roentgenographic examination. This can neither be proved nor disproved. But it is a fact, however, that this form of hypertrophy is of rare occurrence[7] at postmortem and the likelihood of its being present without some element of dilatation is highly improbable. The value of the roentgenogram may also be questioned because it fails to give a complete outline of the heart and therefore certain definite changes in the anteroposterior dimensions may have occurred which were not demonstrated by this technique. However, the roentgen ray is considered of unquestionable value in recognizing hypertrophy with dilatation which occurs in valvular heart disease and chronic myocarditis. This has been verified repeatedly not only at postmortem, but also in the experimental studies on rabbits that developed a progressive hypertrophy following injections of spartein sulphate.[4] If there is speculation as to whether the heart has become hypertrophied and remains unrecognized by the roentgenogram the burden of final proof will necessarily fall on the anatomical examination. Such an examination would undoubtedly give the exact state of the myocardium, the total weight, the thickness of the chamber walls, etc., and would be a critical check for the roentgenographic observations. In making such an investigation, however, the interpretation should be

guarded until some means for excluding conditions such as arteriosclerosis and hypertension as possible causes of hypertrophy are obtained.

SUMMARY

A series of rabbits with normal and abnormal hearts were exercised to exhaustion. Roentgenographic examination showed the hearts to be diminished in size immediately after strenuous effort. There was no evidence of dilatation. A roentgenographic study was carried out on competitors in the Boston Marathon race. In these studies there was no evidence of dilatation of the heart. In most instances the hearts were found to be somewhat smaller immediately after the race and to return to a normal size within a few hours. The runners were also studied for the purpose of noting a permanent enlargement of the heart which could be attributed to prolonged athletic activity. This phase of the study indicated that many years of the most vigorous physical effort did not produce cardiac hypertrophy. It seems, therefore, that exercise does not cause cardiac dilatation and that prolonged athletic training fails to develop hypertrophy of the heart.

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ABSTRACT OF DISCUSSION

Dr. L. T. LeWald, New York, stated that his observations on Marathon runners and on aviators confirmed Dr. Gordon's conclusion that acute dilatation is not a usual result of strenuous exercise and that hypertrophy does not usually follow long-continued athletic exercise.

Dr. H. K. Pancoast, Philadelphia, said that for several years he has been on a committee appointed by the National Tuberculosis Association, with Drs. Baetjer and Dunham, to study the normal chest from the roentgenologic standpoint. During the past two years they have examined the chests of a considerable number of students who are athletes, football players, crew men, and runners, and have found that there is no enlargement of the heart in any of these men. This was particularly noted in one of the world's greatest runners who showed no cardiac enlargement in spite of the fact that one lung was almost obliterated by the presence of pleural thickening and adhesions.

THE DIAGNOSIS AND TREATMENT OF INTRATHORACIC LYMPHADENOPATHY FROM A ROENTGENOLOGICAL VIEWPOINT

PRELIMINARY REPORT

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WOODLAND, CALIFORNIA

IN choosing this subject for consideration, the writer has had a two-fold object in mind:

First, to bring out the need for new research in our field, for it is evident that roentgenology, or rather roentgen therapy, is again on the back-swing of the pendulum. Since 1919, with the advent of the 200 kv. Coolidge tube, we have been bound up in cancer therapy. By proper filtration and tremendous voltages which were eventually to be made possible, malignancy was to have had almost a specific. In these seven years we have observed, to our disappointment, and many times to our chagrin, that, though we have a very valuable adjunct in the treatment of malignancy, we have no near-specific. True, we are not at the end of our investigations—science never is—but the panacea dreamed of by many has not materialized and radiation and radiologists will be subjected to many adverse comments as a result of having too much expected of them in the field of malignancy. It is therefore necessary for the roentgenologist, as such, to develop wider fields of application, for, since the radiation therapy of malignancy has been placed on a fairly stable basis some of us must turn our attention to other fields of endeavor.

The second reason for this choice of subject is the hope of clarifying, to some slight degree, a subject which, though very important, is viewed with doubt both as to possible pathology and interpretation.

Very recently at a gathering of a group of roentgenologists the question was asked: "What constitutes a normal hilus shadow and what constitutes a pathologic one?" There was no one of the men present who could give a definite word-picture, nor was there one who was certain that the conditions which he considered pathologic were always in reality significant of disease or that the conditions which he considered negative were, without doubt, within the limits of the normal.

The hilus shadow, of necessity, is made up by the following structures: (1) The vascular structures which enter and leave at the root—these probably constitute the major portion of all normal hilus shadows; (2) the large bronchi; (3) the fibrous tissue and pleural reflections; (4) lymphoid structures. I have attempted to place these in the order in which I believe they produce relative radiopacity, in the normal chest.

Anatomically speaking, the lymph glands of the thoracic cavity are given the following classification by Bartels:

1. Mediastinal
   - Anterior
   - Posterior
2. Bronchial
   - Tracheo-bronchial, right and left.
   - Inter-tracheo-bronchial
   - Broncho-pulmonary
   - Pulmonary

There is, in the case of the lymph glands in the chest, as in all parts of the body, a profuse anastomosis of the lymphatic channels so that all of these nodes as classified above either anastomose directly or indirectly with one another. The connection is also very free and, at some points, the system is continuous with the lymphatic channels of the neck and trunk so that they very frequently are all involved in the same pathologic processes. Normally, these nodes are never larger than a navy bean, but in pathologic conditions they may, as we all know, increase almost without limit as to size. If they did not exceed the normal in size, they would never be roentgenologically demonstrable.

Considering the types of adenopathies which may be observed within the thoracic cavity we have primarily tuberculous adenopathy which accounts for perhaps 80 per cent of all intrathoracic glandular enlargement. Second, there is the secondary adenopathy found in the acute infectious diseases of the chest chief among which are the pneumonias, influenza, bronchitis, bronchiectasis and pertussis. Third are the various blood cell malignancies, if we may speak of them as such, including the leucemias, lymphosarcoma and Hodgkin's granuloma. Fourth is syphilis, another disease which frequently is a causative factor in this condition. Fifth, metastatic malignant glands may produce the picture, though this condition is very rare.

For the purpose of this paper we are not especially interested in the mediastinal portion of the intrathoracic lymphatic system nor will we consider the blood cell malignancies, syphilis or metastatic malignancy, our chief interest lying in those infected glands which are of a definite tuberculous or pyogenic origin. Hence the consideration of the former conditions will have no place in this article.

There are certain clinical findings which have been definitely given a place in the diagnosis of hilus adenopathy, the history furnishing us information of a rather definite character. The patient is generally under twenty years of age, and is most frequently under ten. He may or may not have a rise of temperature in the afternoon, varying from 99° to 100°. There generally is a cough and, if the patient is in early childhood, croup is frequently diagnosed by the mother. There is the preadolescent retardation of development so often ascribed to hypertrophic tonsillitis and adenoids, and in conjunction with the adenopathy, the latter two conditions generally prevail. In about 50 per cent of the cases there is a definite cervical adenitis. The child is very frequently subject to recurrent colds; one is no sooner broken up than a new one appears to take its place.

Certain physical findings are also of great value in making such a diagnosis. Probably the most prominent one is the d'Espine sign which is an extension of the normal dullness on percussion, beyond the fifth vertebra. The spinalgia of Petruschky is a symptom which is noted in approximately 50 per cent of the cases according to some writers. In this test pressure over the spine in the upper dorsal region causes the child to complain of pain.

Positive cases giving this type of history and physical examination, and some which lack many of these findings, give very definite positive roentgenographic evidence of this type of pathology. In the main this consists of a shadow, or shadows, with a rather definitely demarcated outline either in the hilus region or located in the pulmonary tissue proper, depending upon which group or groups of glands may be involved.

The hilus shadow, as stated previously, is the subject of much dispute and controversy, and until recently I was aligned on the ultra-conservative side which demands that a very prominent clean-cut shadow must be noted before we should even mention a hilus. This attitude is well expressed by Wessler and Jaches in their recent most excellent volume on Diseases of the Chest, in which they state:

"The interpretation of the hilum shadows has given rise to much confusion from a failure properly to appraise the pathological changes which are so frequently present at the roots of the lungs. Pathological studies show the almost universal occurrence either of hyperplasia and anthracosis of the bronchial lymph nodes and also caseation and calcification resulting from tuberculous involvement of these nodes. In addition there is often an increase in the connective tissue about them. The root shadows which we see in adults therefore practically never reflect a normal condition. Nevertheless, so common are these changes at the root and so rarely are they responsible for any symptoms that no clinical importance need be attached to them. It is particularly unfortunate that an enlargement of the shadows at the roots of the lungs has so often been made a basis for the diagnosis of pulmonary tuberculosis by roentgenologists.

"In the normal hilum the shadows are of moderate density, shade off almost imperceptibly into the lung tissue and the markings of the large vessels and bronchi are faintly indicated within it. The normal lymph nodes are not distinguishable as they are merged in the general shadow mass. Such a hilum for the reasons given above, is rarely encountered. In the average adult the hilum extends further into the lung fields, sometimes for a considerable distance. The shadows are denser and some of them, representing hyperplastic lymph nodes, are discrete and distinct in outline. Anthracotic and calcified nodes and those which are caseous cast very dense clearly outlined shadows. Irregular dense shadows, sometimes in ring form may be due to deposits of lime in tuberculous nodes . . .

"Although the hilum of the lung has up to recent times loomed large in the reports of roentgenologists,

experience has taught that inferences drawn from it are of little value in clinical diagnosis. In the vast majority of cases, particularly in adults, the changes which are discovered at the roots have no clinical significance and aside from noting their presence, they are best disregarded . . .

"There is perhaps no subject which has given rise to more confusion in the interpretation of chest plates than chronic disease of the bronchial lymph nodes. This is mainly owing to the failure of roentgenologists to distinguish between infection and clinical disease. The dense, irregular shadows which are commonly seen at the roots of adult lungs are undeniably due to an enlargement of the lymph nodes; but it is another matter, in a case of thoracic disease, to regard them as related to the disease. In fact, in adults at least, it is questionable whether such enlarged lymph nodes, which are usually indurated and anthracotic, contribute anything to the clinical picture. The cough and expectoration which may be present in these cases, are more logically referable to an underlying bronchitis, which causes both the symptoms and the glandular enlargement. We may often find these symptoms together with glandular swelling as a result of chronic accessory sinus disease.

"These considerations have a most important bearing on our interpretation of the shadows of tuberculous bronchial lymph nodes. The changes in these nodes by which we recognize them as tuberculous are essentially caseation and calcification, which cause the shadows to become very dense and irregular. These changes may be noted in the broncho-pulmonary and tracheobronchial nodes and in adults very rarely in the paratracheal nodes. The glandular enlargement is always moderate and never attains the dimensions of the tuberculous adenopathy in children. We must now ask ourselves what significance from a clinical standpoint is to be attached to the discovery on a roentgen plate of a number of enlarged tuberculous nodes at the roots of the lungs. The clinician has repeatedly presented to him the problem of a patient who has a slight daily rise of temperature, with or without cough and in whom the roentgen plate reveals only the shadows of presumably tuberculous bronchial nodes. The question arises whether such nodes are a sufficiently common cause of pulmonary or other symptoms that their presence in an individual case will warrant us in assuming that they are the cause of those symptoms. Decidedly not. Glandular tuberculosis is almost universal in adults, yet it is practically always a quiescent infection which gives rise to none of the clinical symptoms of tuberculosis. If, in a given case, no infiltrations are seen in the lungs, the examiner will wisely disregard the enlarged lymph nodes and will look elsewhere than in the chest for the cause of the fever. The roentgen examination in this type of case will therefore be of value in a negative sense, in that it will serve to exclude tuberculous disease of the lungs and direct attention to other foci such as the teeth or the tonsils or the accessory sinuses."

It was not until, in conjunction with the medical department of the Clinic, an investigation was begun and roentgen therapy directed at some of the suspicious, but not positive, hili, according to the conservative interpretation, and results obtained through this procedure that I came to find myself aligned on the more radical side of the question. As stated before, most of these patients are under ten years of age and, in children, we should expect to find the normal to exist more commonly in all parts of the body including the hilus. They have not been subjected to the years of infection that the adult has. Hence abnormal or borderline opacities in any amount in the hilus region of a child are more significant than a corresponding condition in an adult. Also, in the adult, we have the accumulation of the years of inhalation of solid materials such as dust, carbon, and silica which is taken up by all of the pulmonary tissues including the bronchi and lymphatics. These substances are all more or less opaque and combine to make the average shadows which, while they are not exactly normal, yet cannot be classified as pathological in the sense of pathology meaning disease. In reporting our opinions on examination, we may state that the hilus shadow is within normal limits. Yet how do we determine such limits? What norm have we to refer to? Only that we have seen many films in which the patient was evidently free from intrathoracic disease in which such shadows had been demonstrated.

What is the pulmonary picture, roentgenographically speaking, in these patients with clinical evidence of adenopathy? I will say that I have yet to see any case showing hilus adenopathy in a child, barring the acute infectious processes, which does not show evidence of either active or inactive pulmonary tuberculosis in the corresponding lung. Quite frequently we find even in very young children—I have noted it in a number of cases under three years of age—definite areas of calcification in the hilus, which mean but one thing, namely, the calcification of a tuberculous gland.

It is true that there are those who contend that this infection is a descending one in a high percentage of the cases, i.e., the tonsils are the primary focus and drainage has been accomplished through the usual cervical channels and the hilus infection has been resultant upon the other two. Others go so far as to say that the extension may proceed from this point to the pulmonary tissue proper and an active pulmonary tuberculosis be produced.

In connection with this question, the experiments of Griffith are of much interest. He fed 92 animals of various types, including monkeys, with tuberculous food and found that the tonsil was infected in 25 per cent of the cases, the cervical glands in 54 per cent. He does not mention the hilus glands, hence I presume they were not studied. Griffith uses this as an argument for the descending infection theory, but it appears to me that the subject is far from being proven as there are many other modes of transmission, food and bacteria necessarily having to traverse the entire gastrointestinal tract and infection and transmission could have occurred at any point along it. There are many who adhere very strictly to this theory and they invariably point to the frequent coincident occurrence of cervical and hilus adenopathy. This is recognized as an argument in favor of that theory, but it in no wise proves the contention for there are cases on record in which inguinal and cervical nodes were affected without other involvement.

In contradistinction to the descending theory is that which assumes a primary pulmonary focus responsible for all tuberculous hilus adenopathy. This basis appeals to me most strongly in view of my observation previously noted, i.e. a pulmonary focus has been discernible in each case.

The nontuberculous adenopathies, as previously stated, pertain chiefly to the various intrathoracic acute infections and generally we find the adenopathy receding rapidly following the dissipation of the primary disease. In these conditions the roentgenologist ordinarily expects to find large hilus glands, so that no particular difference of opinion exists concerning them, their consideration being included merely for the sake of completeness.

The therapy directed at these glands is necessarily the therapy directed at the disease itself which is the etiological agent in the production of the adenopathy. Occasionally following pertussis we have a persistence of the adenopathy after the disease apparently has subsided and the same roentgen therapy can be applied to this condition as is used for the tuberculous adenopathies.

The therapy of these cases includes the usual routine for the treatment of pulmonary tuberculosis, i.e. tuberculosis in all forms is a systemic disease, at least it always has systemic potentialities, and must be treated, not as a local condition, but as one which involves the entire organism. Hence the patients are under the care of the department of medicine and are instructed, or their parents are instructed, as to the essential management of the tuberculous. This, of course, includes rest, high caloric intake, fresh air, sunshine, quartz mercury lamp exposures and, in general, a scheme of constitutional building up. In addition to this, roentgen therapy is now being administered routinely in all these cases.

Why should roentgen rays produce a regression of tuberculous or pyogenically infected nodes? In the first place, lymph nodes are composed chiefly of lymphocytes; the stroma itself, especially in hypertrophied glands, makes up only a very small portion of the node. In the tuberculous gland, we have the giant cells as well as the lymphocytes. Lymphatic tissue is recognized to be the most susceptible of all the tissues to irradiation. Russ, Chambers and Scott found that the exposure of a rat for $\frac{1}{40}$ of a second to such rays as would not even fog a photographic plate, would, in one hour, cause a reduction of 20 per cent in the lymphocyte count. Further exposures, that is, of longer duration, would destroy approximately 50 per cent of them, thus clearly demonstrating the destructive effect of roentgen rays on these cells. It is always only 50 per cent of the cells which are destroyed even though the irradiation is pushed to the limit of tolerance. Now, are these other 50 per cent another type of lymphocyte and have we destroyed a certain kind of these cells with the result of allowing others to do better work? These are questions I cannot answer. Their destruction may cause the liberation of certain substances toxic to the bacteria or it may be that these cells which have been destroyed are of a protective nature to the infecting organism and their dissolution allows other forces to combat the bacilli. Another theory is that the giant cells are destroyed thereby liberating the bacilli which they may have within them for destruction by the lymphocytes. And still

another theory is that the opsonic index is raised by the irradiation. The proponents of this theory make no attempt to note through what means the index is raised but have found experimentally that such is the case. I personally can subscribe to none of these theories, but believe that much valuable research could be expended on this subject, for, while it is theoretical, it none the less has a very practical side.

Two deaths have been noted by Carter following irradiation of tuberculous lymph nodes, both due to acute miliary tuberculosis. However we find patients dying from miliary tuberculosis every day and a report of two cases only, considering the great number of cases treated by roentgen rays does not indicate to my mind anything more than a coincidence.

You will probably judge from what has been said before that, in my work, I am using short wave therapy in the treatment of tuberculous adenopathy. I am and I am not. The only factor which decides as to the type of ray utilized is the depth of the lesion beneath the surface. I do not favor a set technique for the treatment of a pathological entity regardless of situation, and we most certainly cannot consider tuberculosis of the tonsil, tuberculosis of the cervical nodes and tuberculosis of the tracheo-bronchial glands as the same condition in so far as roentgen therapy is concerned. As yet I have not established any definite technique for the irradiation of hilus glands, my work still being in the experimental stage. I have seen these glands recede under treatment utilizing 100 kv. and 4 mm. aluminum filter. I have seen them recede with equal rapidity and with as satisfactory an end result with the use of 180 kv. and 0.5 mm. copper plus 1 mm. aluminum filter. In so far as the patient is concerned, the reaction and end result are, within the powers of observation, identical. The time of treatment also varies with the other factors as would necessarily be the case. However it is my practice to give repeated doses rather than one massive dose. A one-third erythema dose of short rays or a two-thirds erythema dose of longer waves is administered and the patient is advised to return in six weeks. At this time a second physical and roentgenographic examination is made and progress noted. If there is still some residual adenopathy a second irradiation is administered. This is repeated at six-week intervals until cure. It has been unnecessary in any case to give more than three treatments to produce a complete regression of the adenopathy and a corresponding clinical improvement.

These measures have been in practice at the Clinic for less than one year and, although a considerable number of patients have been treated, there are many more in the process of treatment and this article will, of necessity be only a preliminary report and survey of impressions gained thus far. It is anticipated that, at the close of another year, a considerable series of cases will be worked out to the point where they can be reported in such a way as to give more detailed information.

CONCLUSIONS

1. Hilus adenopathy, chiefly of a tuberculous origin, is an entity.

2. Recognition of this condition must be given by the roentgenologist, and mutual cooperation must exist between him and the internist both in diagnosis and treatment.

3. This pathology, if tuberculous, is generally, if not always, dependent on a primary pulmonary focus.

4. This adenopathy is amenable to roentgen therapy which should be used in all cases in conjunction with the usual medical and hygienic treatment.

THE ROENTGENOLOGIC DIAGNOSIS OF GASTROJEJUNAL ULCER*

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THIS report is based on a review of 200 cases of gastrojejunal ulcer seen at the Mayo Clinic during the last ten years. Of these cases, gastroenterostomy had been primarily performed at the clinic in 97 (48.5 per cent), and elsewhere in 103 (51.5 per cent). During the same period gastroenterostomy was performed in 4,146 cases in the clinic. The group of 97 cases, therefore, indicates that the incidence of gastrojejunal ulcer following gastroenterostomy was 2.3 per cent. While unquestionably there are cases in which there is as yet no record of gastrojejunal ulcer having followed the gastroenterostomy, this fact is offset by the inclusion, in the 97 cases, of many in which operation had been performed prior to the ten-year period.

In the series of 200 cases, 186 (93 per cent) were in men, and 14 (7 per cent) were in women. It must be borne in mind, however, that peptic ulcer is found much more frequently in males.

The average age of the patients was forty-two years, the extremes being sixty-nine and fifteen years; 74 were between the ages of thirty and forty-nine years.

The original lesion was duodenal ulcer in 89 per cent, gastric ulcer in 4.5 per cent, and in the remaining 6.5 per cent (all among the cases in which the primary operation was performed elsewhere) either no evidence of previous ulceration could be found, or its exact situation could not be determined.

The time which had elapsed between the gastroenterostomy and the discovery of the gastrojejunal ulcer varied from twenty-one years in one instance to six weeks in another. Sixty were found in the first two years, 103 in the first four years, and in 19 cases the secondary ulcer was not discovered until more than ten years after the primary operation.

ETIOLOGY

Gastrojejunal ulcers have been attributed to various causes chief among which are infection, either from the primary ulcer, other intra-abdominal lesions or some distant focus; trauma at operation by clamps or other instruments; non-absorbable suture material, and persistent hyperchlorhydria. The reports of other series of cases and the study of our own lead us to believe that these secondary ulcers occur as a result of a combination of factors rather than any one. While the primary ulcer may be the source of the recurring infection in certain instances, its importance is minimized by the appearance of gastrojejunal ulcers following failure to demonstrate a primary ulcer at the original operation. Judd records 15 such cases,[4] and Moynihan two. In this series only 9 (4.5 per cent) followed gastroenterostomy for gastric ulcer in which the primary lesion was destroyed either by the cautery or by knife excision.

Hyperchlorhydria is a fairly constant finding in cases of gastrojejunal ulcer, but ulcers do occur in the presence of persistent achlorhydria.

Gastrojejunal ulcers are encountered following resection of the stomach for peptic ulcer. Unquestionably, trauma and irritative sutures are of etiologic importance, yet gastrojejunal ulcers occur in cases in which trauma was reduced to a minimum and catgut only was used in suturing. Whether some persons have an ulcer-forming tendency is speculative, nevertheless it seems certain that secondary ulcers occur as a complication of all types of gastrointestinal anastomosis and in spite of all preventive measures.

PATHOLOGY

Moynihan has found that gastrojejunal ulcers are usually single and are smaller than the ordinary peptic ulcer; this has also been the experience in the Mayo Clinic. However, the ulcers may be multiple and occasionally so large as to simulate grossly a carcinoma; in one of our cases the crater was 4 cm. in diameter. In no case

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have we seen stomal ulceration become malignant, nor have we been able to find a report of such in the literature. Gastrojejunal ulcer conforms to the usual types of peptic ulcer, namely, mucous, penetrating, and perforated. Besides these, we have observed a definite group of cases in which the margins of the stoma and adjacent portions of the stomach and jejunum were subacutely inflamed and so congested as to stipple when handled. In one case the colon was so adherent to the anastomosis as to suggest an impending perforation. No localized ulceration can be demonstrated in these cases, yet a microscopic examination of the tissue removed from the stoma shows a definite inflammatory process with marked lymphocytic infiltration. These cases give the classical symptoms and roentgenologic findings of gastrojejunal ulcer.

Penetrating ulcers are by far the most common type of gastrojejunal ulcer. They are usually situated in the suture line or in the jejunum close to the anastomosis. In one of our cases the ulcer was in the efferent loop at least 9 cm. from the stoma.

Perforated stomal ulcers are quite common, and may produce a definite abscess which may excavate either anteriorly or posteriorly. By far the most frequent complication caused by the perforation of a gastrojejunal ulcer is a fistula into the colon. When a gastrocolic fistula is found, the communication may be either at the anastomosis or between the colon and jejunum several centimeters from the stoma. In this series there were 17 cases of gastrocolic fistula.

SYMPTOMS

Eusterman has noted that the symptoms of gastrojejunal ulcer appear early, usually within the first year. Nevertheless, they may not appear for a long period after the gastroenterostomy. The most important symptom is the recurrence of a digestive complaint that has been relieved for a time by gastroenterostomy. As Balfour has said, the new symptoms differ from the old in that the pain is usually lower in the abdomen and more to the left side, and is ess severe. Periodicity is not common, nor do food and alkalis give the relief that was noted with the primary complaint. Hemorrhage may occur and is suggestive, especially when there has been no bleeding from the original ulcer.

The chief difficulty in the clinical diagnosis is the distinction between a gastrojejunal ulcer and a reactivated peptic ulcer. In this differentiation the roentgenologic examination is a valuable aid.

NORMAL ANASTOMOSIS

Before an accurate interpretation of the roentgenologic signs of gastrojejunal ulcer can be made, it is essential to understand the characteristics and to recognize the appearance of a normal anastomosis. According to Moynihan, in order to insure the proper functioning of the stoma the opening should be not less than 6.25 cm. in length, and should be placed in the most dependent part of the stomach. This procedure is followed in the Mayo Clinic, the jejunal loop being turned to the left and made sufficiently long to prevent traction at the anastomosis.

When viewed on the roentgenoscopic screen, if the stoma is normal, the opaque medium after entering the stomach spreads out more or less fan-like against the gastric walls until it reaches the opening through which it passes into the jejunum. The flow into the jejunum may be constant or may come in spurts. Härtel attributes these intermissions in flow to the passage of peristaltic waves over the stoma, while other observers ascribe them to the formation of a sphincter mechanism around the opening. We have not been able to find any proof of the latter statement, nor have we ever known of any proved case of shrinkage or closure in a stomal opening without a previous infection. Apparently the rapidity of the flow is greatly influenced by abdominal tension, muscular relaxation greatly facilitating the passage through the stoma.

The stomach after gastroenterostomy is usually smaller than before operation, but if its tone was greatly decreased by previous obstruction its size may not be changed.

There should be no retention in either the stomach or adjacent small bowel; in fact, the six-hour meal is usually farther advanced than normally. Peristalsis may

be normal or diminished. In our experience it is never increased when the stoma is functioning properly. The stomach is regular in contour except for a slight dimpling at the site of the anastomosis, and usually quite pliant, except in the presence of very extensive adhesions. The gastric rugae appear normal save for a slight convergence and coarsening at the site of the opening. The jejunum is approximately normal in size and shows no unusual irregularity.

ROENTGENOLOGIC SIGNS OF GASTROJEJUNAL ULCER

Carman divides the roentgenologic signs of gastrojejunal ulcer into two groups: the indirect, or those indicating an abnormal condition in the anastomosed stomach, and the direct, or those pointing to the seat of the trouble. In the first group he includes gastric retention, hyperperistalsis, large stomach, gastric spasticity and duodenal dilatation. In the second group are included deformity around the stoma, narrowing and irregularity of the jejunum, scant flow through the opening, and fixation at the site of the anatomosis. As he says, these may occur singly or in varying combinations.

When analyzed these signs all point to one fact, namely, that there is a condition present which prevents an artificial opening in the stomach from functioning properly. In fact, a proper interpretation of the signs presupposes that the original anastomosis at one time functioned to a certain degree in a satisfactory manner. If the stomatal opening was too small, if undue trauma at the primary operation resulted in extensive adhesions, or if the jejunal loop was not of sufficient length or properly selected, the signs of gastrojejunal ulcer may be so simulated as to lead to an erroneous diagnosis. It is of the greatest aid to the roentgenologist to know what type of gastroenterostomy was performed and by whom. We feel much more confident in our examination of patients previously operated on at the Mayo Clinic than of those treated elsewhere, because we know what was done at the original operations.

Except in combination, the indirect signs of gastrojejunal ulcer are indicative only. The most important of these is increase in the size of the stomach beyond what it should be, were drainage satisfactory. A large amount of retention is uncommon except where there is almost complete occlusion of the opening; under this condition hyperperistalsis is common.

Duodenal dilatation is not an uncommon finding in cases of gastrojejunal ulcer, although it may be produced by adhesions, and is of value only in conjunction with other signs.

In eliciting the direct signs of gastrojejunal ulcer the most important evidence is obtained by careful and thorough palpation, so exercised as to expose and permit proper exploration of the stoma and contiguous portions of the stomach and jejunum. This is best accomplished by lifting the overhanging portion of the stomach with one hand and carefully manipulating the field of the stoma with the other, separating the folds of the stomach and small bowel with the fingers and searching carefully for any abnormalities. The patient should be rotated in various directions so that different angles of view may be obtained. The first passage of the medium through the stoma should be carefully observed, for at this time irregularities may be noted that are later hidden by the barium in the bowel.

Deformity of the stoma appears as a retraction and drawing up of the greater curvature. It may be due either to spasm or to cicatricial contraction. It is constant in situation and is unaffected by manipulation. Irregularity and local narrowing of the efferent jejunal loop, like stomal deformity, may be either spastic or organic. It may appear at the suture line or several centimeters distant, and is best demonstrated by palpation. Either retraction of the stoma or narrowing of the jejunum may cause a scant flow of barium which is of great diagnostic value. Fixation of the stoma, when noted, is of diagnostic importance, but it is not a common finding.

During palpation of the stomal area, close observation should be made for possible craters. These appear as small localized areas of greater density due to the retention of barium in the cavity. While these craters do occur, they are not in our experience nearly as common as some observers believe. Particles of barium

held by the rugae of the stomach or by the folds of the jejunum must not be mistaken for true craters. This simulation may account for the large number of niches reported by Ström and others.

While the roentgenologic examination of the stomach may demonstrate the perforation of a gastrojejunal ulcer into the colon and the resulting fistula, we have found that the barium enema will reveal this complication more accurately, the rapid passage of the column into the stomach establishing the diagnosis.

The possibility of anastomosis having erroneously been made between the stomach and a loop of ileum instead of jejunum must be considered. In one case that we have seen, the stomach had been attached by the surgeon a few inches from the ileocecal valve. This permitted the immediate passage of barium from the stomach to the colon and a fistula was suspected.

As already indicated, the greatest difficulty in the diagnosis of gastrojejunal ulcer is its distinction from an improperly performed gastroenterostomy. Obviously, an opening which was not made sufficiently large may be responsible for a scanty flow into the jejunum; undue trauma may, by the resulting adhesions, produce deformity of the stoma and jejunum, and the traction of a very short loop may have the same effect.

A rare condition of which we have seen three instances, herniation of the jejunal loop through the opening in the gastrocolic mesentery, may give roentgenologic signs which resemble those of a gastrojejunal ulcer. In this condition the afferent and efferent loops are involved in the hernia, and are narrowed and obstructed. In two of these cases this occurred within three weeks of the operation, and in the third after some months. The patient's chief symptoms are of obstruction, marked retention being demonstrated both by aspiration and by the roentgen ray. Also, the roentgen ray reveals marked narrowing of both loops at some distance from the stoma, with marked dilatation above the point of constriction. In two of the three cases a doughy mass could be palpated. The early onset, the marked obstructions, the extreme dilatation of the jejunal limbs, and the distance of the narrowing from the stoma, should serve to distinguish this condition from a gastrojejunal ulcer.

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ABSTRACT OF DISCUSSION

Dr. James T. Case, Battle Creek, Mich., stated it to be his belief that some form of control of the gastric outflow is established in most cases of gastroenterostomy. Recently he has reported 15 cases that were operated on more than three years ago and who have been clinically well ever since, in which the emptying time was more than four hours; which is in excess of the emptying time of unoperated cases with the standard meal employed by him. He stated also that direct roentgenoscopic observation of the passage of the barium meal through the gastroenterostomy stoma had fully convinced him that a type of control either at or below the stoma is established in most cases.

Dr. George W. Holmes, Boston, stated that several years ago he had examined about 300 cases of gastroenterostomy just before they left the hospital and again about three years later. He found that the emptying time of the stomach varied greatly in different cases; largely due to the fact, he thought, that some surgeons make a larger opening than others. He asked Dr. Moore if he had found localized tenderness of any value in the diagnosis of gastrojejunal ulcer.

Dr. Moore, in closing, said that what he wished to emphasize with regard to the manner of evacuation of the stomach is that there is no evidence in these cases of the formation of an artificial sphincter at the stoma; examination of the stoma at operation has shown no evidence of the presence of any sphincter. Dr. Moore was not certain whether localized tenderness at the stoma was a common finding in these cases.

THE DISEASED APPENDIX AS A CAUSE OF ACIDOSIS IN CHILDREN*

BY A. L. GRAY, M.D.

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THE late Dr. McGuire Newton of Richmond, presented to the Section on Pediatrics of the Southern Medical Association at its meeting in 1919 a paper[1] in which he referred to the infrequency of chronic appendicitis as compared with the number of acute cases. He advanced the opinion that the non-acute pathological appendix is probably often the cause of a variety of disturbances in children, but from lack of direct evidence this factor is usually overlooked.

With the idea in view that "cyclic vomiting" and other gastrointestinal conditions often referred to as "acidosis" might be due in some instances to a diseased appendix, at his suggestion the writer examined a number of cases in the clientele of Dr. Newton and found that in many of these there was distinct roentgen-ray evidence of disease, either then existing or which had resulted in a definitely abnormal appendix. When this evidence was found, the appendix was removed and in practically every case a complete relief from the attacks followed. These investigations have been carried on since the untimely death of Dr. Newton in 1923 and the results have continued to support his beliefs.

The writer fully recognizes the fact that acidosis may arise from numerous causes other than disease of the appendix, and also that "cyclic vomiting" may be unaccompanied by any depletion of the alkali reserve, but the fact that the two are often associated and may result in serious disability or death justifies every effort to remove all possible causes.

A search of the literature at the writer's command reveals only a single reference[2] to chronic appendicitis as a possible cause of "cyclic vomiting."

The criteria upon which the writer has usually made a diagnosis of a pathological appendix are: (1) abnormalities in the lumen such as local dilatations, clubbing of the barium column at its distal extremity and constant constrictions; (2) marked delay in emptying after the contents of the cecum have been expelled; (3) abnormal fixation or fixed kinking; (4) the presence of retained fecal concretions; (5) tenderness, if it can be elicited, and definitely determined to be in the appendix. It is then a valuable diagnostic factor.

In most of the cases cited, however, no history of pain in the region of the appendix could be obtained and tenderness was entirely absent.

If to these direct signs there is added such indirect evidence as pylorospasm, ileal stasis or colonic spasticity, the diagnosis is further strengthened.

The following cases are reported in the hope that they may act as a stimulus to further investigation and a more general recognition of the value of roentgen-ray examinations for the relief of these little sufferers.

A preliminary report of some of these cases was made in a former paper by the writer[1] before the Medical Society of Virginia in 1920 and subsequent progress to the present time is traced in this report. No case that has not been watched over a period of at least one year since the operation is included in this report.

CASE 1. Male, white, aged nine years; had a violent attack of acidosis at fifteen months of age. After an interval of ten months, he began to have repeated attacks which steadily increased in frequency until at the age of four years it was found that the attacks could be prevented by calomel. This child was given calomel at intervals of three weeks for a period of four years. He was nearly free from his acidosis during this period, but he had begun to have frequent attacks of headache and consti-

[1] Gray, A. L. Clinical manifestations of chronic appendicitis in children. *Virginia M. Month.*, 1921, xlvii, 538.

[1] Newton, M. Chronic appendicitis in children, with report of a case. *Southern M. J.*, 1920, xiii, 166.

[2] Comby. *Arch. de méd. d. enf., Par.*, 1905, viii, 741.

* Read at the Twenty-sixth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Washington, D. C., Sept. 22–25, 1925.

pation and on January 18, 1919, was referred for a study of his gastrointestinal tract.

Roentgen examination revealed a tortuous appendix 4 or 5 inches long containing fecal concretions near its tip and a constricted lumen proximal to the concretions. Its tip was firmly fixed in the iliac fossa. There was not the slightest tenderness on pressure over it.

Operation on January 27, 1919, revealed "a very large appendix 5 inches long fixed at its tip. The appendix showed two enteroliths each about the size of a date seed—one at the tip of the appendix and the other 2 inches from the appendicular opening. The appendix was subacutely inflamed, the blood vessels engorged, and the middle third of its lumen much narrowed."

It is now five years and eight months since the operation. An interview with this patient on Sept. 11, 1925, elicited the fact that he has had no attack since his operation and is now a robust youth weighing 136 pounds.

Case II. Female, white, aged seven, began "cyclic vomiting" at the age of three years. These attacks lasted from one to three days and were attended by constipation and high temperature, but no abdominal pain nor tenderness. During the intervals between attacks she was constipated, requiring laxatives; she was highly nervous and irritable, her appetite was poor, she became very anemic and was considerably underweight. She frequently complained of abdominal discomfort, which was relieved by rubbing.

Roentgen-ray examination on April 2, 1919, revealed a moderately dilated cecum extending low into the lesser pelvis from which position it could not be removed. An appendix with very small lumen was seen coiled behind the cecum, from which fixed position it could be displaced.

Operation on June 30, 1919, was reported as follows: "Cecum of mobile type, with long mesentery, which permitted considerable motion and was easily delivered on abdomen. Appendix lay behind the cecum and was curled up and firmly adherent and contained several small concretions distal to this. The appendix was very hard and distended and about 3 inches in length and nearly as large as the little finger."

In this case the contents of the lumen had prevented complete filling and no very definite idea of the size of the appendix could be obtained. The long mesentery had permitted the cecum to swing into the lesser pelvis where it was imprisoned by the pelvic organs so that it could not be released by manipulating at the time of the roentgen-ray examination.

The patient's mother reports that she is now entirely well, Sept. 11, 1925, and has had no attack since the operation.

Case III. Male, white, aged six, began to have bronchial asthma and acidosis after his first year, following eating an egg for the first time. Attacks became frequent, the two conditions appearing to alternate with each other. The acidosis attacks were lessened somewhat by a monthly dose of calomel, but his asthma did not materially improve.

A gastrointestinal roentgen examination was made Nov. 3, 1919, which revealed a moderate pylorospasm and an appendix curved and fixed in the right iliac fossa with what appeared to be non-obstructing adhesions binding the small intestinal coils in the right lumbar region.

Operation on Nov. 7, 1919, verified the roentgen-ray report.

For more than a year after the operation there was no attack of acidosis. There was, however, an occasional attack of asthma. Later attacks similar to the former occurred. The child was found to have a pan-sinusitis with ethmoid involvement, and polyps were present. These were removed and the ethmoids and sinuses drained and he has had practically complete relief.

Case IV. Female, white, aged four and one-half years; began to have attacks of acidosis at two years of age and had them regularly at intervals of two or four weeks. Despite dietary and medicinal measures she continued to have them without abatement in frequency or severity.

A gastrointestinal roentgen examination was made April 1, 1920, which showed an appendix irregularly filled, 3 or 4 inches long and shaped like an interrogation point. The tip appeared to be fixed to the inner side of the ascending colon near the hepatic flexure. Its middle was movable, but the lumen was markedly dilated. About 1 inch from the base there was a constriction. The tip of the appendix showed a vacuole.

Conclusion: Patient has a very long dilated appendix with a constriction near its base and probably a fecal concretion near its distal extremity. Patient's symptoms are probably the result of the condition of the appendix.

Operation April 13, 1920, as reported by the surgeon was: "McBurney's incision. Long, patent, large subacutely inflamed and chronically diseased appendix removed."

The following letter from her physician dated Oct. 16, 1920, was received:

"Replying to your letter of the 15th will say that M. D. H. was operated on . . . on April 13, 1920, returning home from the hospital on April 22, and from that time to this, her health has been perfect.

"It is interesting to note that before the operation she suffered from obstinate constipation. Since, her bowels have been perfectly regular."

He further reported on Sept. 14, 1925, that this child has had no attack at all similar to her previous trouble since the operation.

Case v. Male, white, aged three and one-half; had several attacks of vomiting and fever. Attacks were preceded by tonsillitis. Child had complained of pain in the abdomen of a general character, but no tenderness until ten days after the occurrence of the pain, when there appeared to be some rigidity. Patient had a slight attack of colitis following a trip to the seashore six weeks before.

He was referred for examination of the appendix on Sept. 12, 1924. The roentgen-ray examination revealed six-hour gastric residue of 50 per cent. At this time the appendix was not identified. Twenty-four hour examination showed what appeared to be the appendix well filled, dilated toward the distal end and kinked in the center. No tenderness whatever on pressure over it. Examination of films led to the belief that what was thought to be the appendix was the terminal ileum. A second meal was given and films made at 6, 24, and 30 hours. It was then determined that the appearance first thought to be the appendix was a tremendously dilated appendix constricted toward its base and fixed by adhesions or imprisonment in front of the right side of the 4th lumbar vertebra. A diagnosis was therefore made of a pathological appendix as the probable cause of the patient's illness.

Operation on Sept. 20, 1924, verified the roentgen-ray findings. A greatly enlarged subacutely inflamed appendix was removed.

After operation the patient had a severe nasal cold, on December 25, 1924, which was attended by some fever. In April, 1925, following too free indulgence in ice cream there was another feverish attack.

His mother reported on Sept. 14, 1925, "His condition is now splendid. He seems to have been entirely relieved of an obstinate constipation, which had troubled him practically all his life. He is now robust and healthy."

Case vi. Female, white, aged eight, began to have attacks of acidosis at four years of age. Tonsils removed two years afterwards and the attacks ceased for nearly two years when they recurred with increased severity, threatening her life.

Roentgen-ray examination showed an appendix irregularly filled, forming an "S" to the inner side of the cecum, freely movable, no tenderness. Case was reported as showing no definite indication of chronic appendicitis.

After a slow recovery the patient remained in fairly good health for more than three years after which she began to have attacks of acidosis worse than at any previous time. She was again referred for roentgen-ray examination. This also failed to reveal any definite evidence of appendix involvement. Her condition grew more grave and several eminent pediatrists were called in consultation. No one of these was willing to admit that the appendix was a possible cause of her trouble.

From previous experience in these cases the writer insisted that despite negative roentgen-ray findings the patient had appendicitis.

When the patient was nearly moribund, the appendix was removed as a last resort. It was found to be of normal contour, freely movable, but subacutely inflamed. After a slow but steady convalescence, this child completely recovered and when seen by the writer during the present summer was of normal weight, strong and vigorous, and her mother reported that there had been not the slightest recurrence of her former trouble.

This case also demonstrates that it may be hazardous to attempt to exclude appendicitis by roentgen-ray examination.

DYSCHEZIA*

BY HARRY J. ISAACS, M.D., AND M. I. KAPLAN, M.D.

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DYSCHEZIA, or torpor recti, constitutes a special form of constipation. In many cases of constipation it is found on examination that the rectum is filled with feces. On examining these patients roentgenologically one notes that there is no delay in the propulsion of the stool (or barium) through the proximal colon, and it is only when the sigmoid flexure and the rectum are reached that the progress ceases. The rectum itself is markedly dilated. This means that dyschezia is a condition causing symptoms of constipation where that portion of the gut charged with the actual expulsion of the fecal matter fails to act. In these cases the barium is retained for days in the sigmoid flexure and rectum, while the upper portions of the colon are emptied in the proper time.

The symptoms of dyschezia are chiefly those of constipation, with occasionally a high degree of meteorism, abdominal pain and nausea; in fact the beginning symptoms of ileus. In many cases individuals who have the accumulation of a large fecal mass in the rectum may evacuate small fragmentary stools, thus misleading one as to the existence of constipation. The rectal examination usually clears the diagnosis.

Matthes[1] reports a case of a little girl who was brought to the hospital because of inability to urinate. The rectum was found to be filled with such a large quantity of feces as to compress the urethra and interfere with the urinary flow. Such a high degree of dyschezia is sometimes encountered in weak, febrile patients, as for instance in typhoid fever.

Pathogenesis of dyschezia has been described by Hurst.[2] He states that the habitual neglect of the call to defecation leads to an accumulation of feces in the pelvic colon and rectum, which become gradually more and more distended. This gradual distention diminishes the tone and impairs the contractility of the musculature. As the force which is necessary to empty the rectum when overdistended with feces is much greater than that required to empty it under normal conditions, the result is that the weakened musculature coat is incompetent to do its work, and even if a great effort be made, the evacuation remains incomplete. As time advances the musculature of the pelvic colon and rectum becomes so atonic and paretic that it can never be restored to its normal condition. Other causes of dyschezia are those which develop secondarily to those conditions which cause pain during defecation, such as inflamed or thrombotic hemorrhoids, anal ulcer, fissures and pelvic peritonitis.

The *diagnosis of dyschezia* is comparatively simple when one proceeds to get a history of constipation and on rectal examination finds a marked accumulation of feces. Roentgen examination shows a normal propulsion of barium through the proximal colon and a retention in the sigmoid flexure and rectum. The sigmoid flexure and rectum are markedly dilated and atonic.

The differential diagnosis includes those conditions associated with marked constipation such as (1) atonic constipation; (2) spastic constipation, (3) redundant colon; (4) diverticulitis of the colon; (5) Hirschsprung's disease; (6) organic obstructions of the colon such as malignancy; (6) Meckel's diverticulum; (8) constipation due to anomalies and fissures, and (9) chronic tuberculous peritonitis. Dyschezia is frequently confused with Hirschsprung's disease.

Hirschsprung's disease is caused by an elongation, dilatation and marked hypertrophy of the descending colon, sigmoid and rectum. It is usually associated with kinks, formation of folds, spasms and tendencies to incomplete volvulus, the result of an abnormally large sigmoid flexure. It is common in the first ten years of life. Symptoms of meteorism, obstinate constipation, visible peristalsis, vomiting, and dis-

[1] Matthes' Differential Diagnosis, p. 714.
[2] Hurst, A. F. Constipation and Allied Intestinal disorders. London Oxford University Press, 1909, p. 117.

* From the medical and roentgenological department of Mt. Sinai Hospital, Chicago.

tended abdomen are usually present. If the distention is relieved one may be able to palpate the hypertrophied colon. In contradistinction to dyschezia, the digital examination reveals an empty rectum in Hirschsprung's disease. A characteristic finding of Hirschsprung's disease is the fact that the colon can hold an abnormally large quantity of fluid introduced by the enema.

The *treatment of dyschezia* is that of the underlying condition. As a rule, enema is indicated, for it acts by mechanically distending the rectum and thus forces out the accumulated fecal mass. Preference is given to the small retention enemata. One must attempt to keep the rectum and pelvic colon as free from fecal accumulations as possible. Some get very good results with oil retention enemata; others with water. A pint or two of plain warm water may be used. A half a glass of warm sweet or olive oil may be used nightly as a retention enema. Mineral oil, petrolagar and agarol by mouth have been used with very gratifying results. In mild cases glycerine suppositories may be used. In infants the insertion of a finger tip or of a small bent glass rod into the anus usually sets up the act of defecation. Cathartics are harmful, since they merely irritate the colon whose function is normal, whereas they have no effect in the rectum, which is the seat of the trouble.

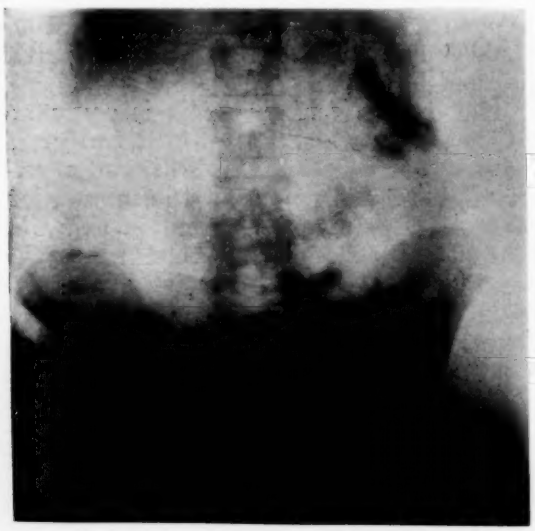

FIG. 1. Shows pathological appendix and dilated, atonic rectum (dyschezia) with a retention of barium of over seventy-two hours.

REPORT OF CASES

CASE 1. Patient C. S., female, housewife, widow, aged forty-three, complaining of constipation, heartburn and epigastric distress. She has been constipated for years, claiming that she could go three and four days without a bowel movement and that an enema would relieve this condition. Her heartburn and epigastric distress have been present for the last seven months, would occur immediately after eating, lasting anywhere from one to two hours. These attacks would occur every two or three months and would last for a period of two to three weeks. No nausea. Baking soda caused some relief of heartburn. Vomiting occurred at times. There is nothing in her previous history, family history, menstrual or marital history which bears any importance in this case.

FIG. 2. Shows dilated, atonic rectum (dyschezia).

Physical examination reveals an anemic, white female, who does not appear to be acutely ill. The essential findings are as follows: Head, neck, eyes, ears negative. Hypertrophied tonsils. Many false teeth in lower jaw. Heart, lungs and abdomen negative. Reflexes normal. Rectal not made.

Laboratory data: Blood pressure 125/70.

Urine negative. Feces negative for occult blood. Blood: Hemoglobin 80, erythrocytes 4,120,000, leucocytes 10,700; differential: N. 67, S.M. 21, L.M. 8, T. 4. Ewald test meal shows free HCl 13 and total 32 with no blood or lactic acid. Blood Wassermann negative. Blood sugar 96 mg. and blood urea 28 mg.

Roentgen examination showed a negative heart and lung. The stomach was elongated, somewhat atonic and showed a small residue after five hours. There were no defects in either the stomach or duodenum. Twenty-four hour examination showed barium in the entire large colon. The appendix was visualized, extremely long, thick, irregularly filled out, freely moveable and not tender. No adhesions along the large colon. Forty-eight hour examination showed the same. Seventy-two hour examination showed barium still in the appendix. The rectum was markedly dilated (Fig. 1) and atonic.

Diagnosis: Dyschezia. Chronic appendix.

FIG. 3. Shows atonic, dilated rectum (dyschezia) with marked spasm of transverse and descending colon.

CASE II. Patient L. V., female, single, cashier, aged twenty, complaining of constipation, diffuse abdominal pain for three weeks with some loss of weight. The pain bears no relation to the intake of food, is associated at times with some nausea but no vomiting. She claims that her pain is dull in character and that rest in bed alleviates the condition somewhat. She has lost eighteen pounds in one year. Constipation for a year. Stools are hard and dry; contain no mucus, pus or blood. There is nothing in her previous history, family or menstrual history which plays any rôle in this case. She states that she does not go to the toilet at a definite hour and many times does not move her bowels for two or three days.

Physical examination reveals a fairly well developed adult female, who does not appear to be acutely ill. The essential findings are: Eyes, ears, nose negative. Mouth negative. Heart and lungs negative. Abdomen: No tumor masses, some slight tenderness in the right upper quadrant. Extremities negative. Reflexes normal. Rectal examination revealed a rectum filled with feces.

FIG. 4. Shows a case of Hirschsprung's disease in a boy aged eight. Retention of barium for five days.

Laboratory data: Blood pressure 120/65. Urine showed a trace of albumen with an occasional granular cast. Blood showed hemoglobin 80, erythrocytes 4,100,000, leucocytes 7,600; differential: N. 52, S.M. 24, L.M. 22, T. 2. Gastric analysis showed a free acidity of 30, total 60, with no occult blood or lactic acid. Feces examination was negative for occult blood. Blood Wassermann one plus. Blood sugar 94 mg., blood urea 29.96 mg.

Roentgen examination showed a hypotonic elongated stomach, with no filling defects, which was entirely empty in five hours. The duodenal bulb filled out completely. Opaque enema: Barium filled the rectum which ballooned out to about the size of eight inches in

diameter (Fig. 2). Spasm at the sigmoid junction, which relaxed at times.

Diagnosis: Dyschezia.

CASE III. Patient D. S., aged thirty, complaining of marked constipation. Roentgen examination shows a marked degree of spasm of the transverse and descending colon, with retention, dilatation and atony of the rectum (Fig. 3).

CONCLUSIONS

1. Dyschezia, or rectal constipation, is a common condition.

2. The roentgen ray is a valuable aid in its diagnosis.

3. It must be differentiated from other causes of constipation.

SKELETAL METASTASIS FROM PRIMARY CARCINOMA OF THE BREAST

BY ROY G. GILES, M.D.

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THE secondary deposits of malignant tumors in bone were recognized by surgeons and pathologists a long time before any definite explanation was available. The older views of the spread of malignant tumors to distant organs of the body was regarded as evidence of "cancer diathesis" or the diffusion of "cancer juice" through the tissues and organs. We now know that the deposit of secondary malignant cells in distant organs is evidence that cancer cells have travelled to the points affected, and are acting as secondary tumors. These detached cellular elements find their way to remote organs by dissemination in the blood stream, by lymphatic embolism, and by lymphatic permeation.

Risley from his own studies and a review of the literature claims that metastasis occurs by either the blood stream or lymphatic system. The embolic conception of the spread of tumor cells seems to many observers to be the explanation of cancerous metastasis to distant organs. Von Recklinghausen was among the first to emphasize the transport of cancer cells through the blood and lymph vessels. Erbsloh, Williams, Shield, Joll, Ewing, and many others are exponents of the theory of the extension of cancerous metastases by means of cell emboli. Handley, on the other hand, believes that secondary cancerous deposits spread to distant organs by lymphatic permeation. He upholds this theory almost to the exclusion of embolic dissemination.

As early as 1834 Sanson reported a case of scirrhous carcinoma of the breast of less than a year's duration in which the woman suffered a fracture of the femur while turning in bed. During the manipulations necessary for the reduction of this fracture, a pathological fracture occurred in the other femur. The postmortem examination revealed extensive cancerous deposits throughout the skeleton. Almost all the segments of the spinal column were filled with carcinoma tissue as well as the frontal bone and the medulla of each femur.

Ritchie and Stewart, in 1896, stated that the majority of secondary cancerous deposits in the bones were secondary to scirrhous carcinoma of the breast. Snow stated in 1891 that he had not seen any cases of distant secondary deposits in the bone that were not secondary to carcinoma of the breast. However, he referred to bone metastases that were secondary to primary carcinoma elsewhere. We now believe that secondary cancerous deposits in the bones may occur in connection with primary carcinoma in any organ in the body.

Carcinoma of the breast is without doubt the most common source of bone metastasis. However, if one considers the high percentage of carcinoma of the breast, the relative percentage of secondary cancerous

deposits in the bone will be materially reduced. Roger Williams collected from the literature 893 postmortems of carcinoma of the breast, and found 26.5 per cent with secondary cancerous deposits in the skeletal system. Gross, from 423 autopsies, found the bones involved in 20.5 per cent. Handley made a very complete study of 329 autopsied cases occurring at the Middlesex Hospital during the thirty years between 1872 and 1891, and found secondary cancerous deposits in the bones in 73 cases, or slightly more than 22 per cent. Ewing asserts that Kaufman in 63 autopsies found 33 (53.3 per cent) with bone metastases.

Fraenkel studied 150 cases coming to autopsy with primary malignancy somewhere in the body and found 30 cases, or 20 per cent, with secondary deposits of cancer in the bones of the vertebral column. He reports the postmortem findings in 10 primary carcinomas of the breast with 6 cases, or 60 per cent metastasizing to the spine.

Schmorl in 1908 found that 34 per cent of all cases of primary carcinoma coming to autopsy showed secondary cancerous deposits in the bones. He concluded that osseous metastasis was not always discovered until the medulla of the bone was opened up and a careful microscopic examination made.

There is considerable diversity of opinion as to the frequency of skeletal metastasis, as well as to the frequency with which individual bones are attacked. This uncertainty is probably due to the fact that autopsies on cancer patients rarely include a complete examination of the entire skeletal system. Symmers writes that bone metastases may be single or multiple, visible or palpable, or so successfully concealed that they may not be detected at postmortem. The few observers who have adopted the detailed method of examination as suggested by Schmorl and others, have found that secondary cancerous deposits in the bones are far more common than would be suggested by external examination alone. Also that bones usually regarded as immune from metastasis may contain minute secondary deposits in the marrow.

Ewing asserts: "The bones most frequently involved are the sternum, ribs, femur, vertebral column, cranium, humerus and clavicle." According to Handley the liability of the bone to cancerous metastases increases with its proximity to the site of the primary growth. He made a careful study of 329 autopsied cases of carcinoma of the breast, and found the bones involved in the following order: the sternum, ribs, femur, spine, skull, humerus, clavicle, scapula, patella, and bones of the hand. Handley believes the rare instances of secondary cancerous deposits in the bones below the elbow and knee are to be explained on the basis of the lymphatic permeation theory.

Piney claims that secondary deposits of cancer in the bones almost always occur in the red marrow, as for example in the ribs, spine, skull, sternum, and upper ends of the humerus and femur. He explains the infrequency of involvement of the bones below the elbow and knee on an anatomical basis, since there is very little red marrow except in the diaphysial ends of the long bones. Risley asserts that metastasis is very rare below the elbow and knee, and explains this infrequency by the fact that death usually intervenes before the process extends to these regions. According to Osler, Stephan Paget analyzed 650 autopsies in cancer of the breast and did not find a single instance of deposit of secondary cancer in the bones below the elbow and knee. Osler writes there is widespread generalization of bone metastasis in a few rare instances. He reports a case which showed a solid fusiform tumor involving the metacarpal of the right thumb, clavicle, and later showed involvement of the left knee and ankle. Beatson recently reported a case of primary carcinoma of the breast in which there was extensive secondary cancerous involvement of the bones below the elbow and knee.

Skeletal metastasis may continue for a considerable time without producing any symptoms whatever. The frequent reports of pathological fractures occurring in patients who apparently enjoyed perfect health, and in whom the accident revealed for the first time the presence of cancer,

bear out this statement. We have observed cases of primary carcinoma of the breast with only apparent involvement in the axillary nodes, yet metastatic areas were harbored in the bones which did not manifest themselves clinically. Roentgen-ray studies are required to reveal silent metastasis in the chest and in the osseous system.

Two types of carcinoma of bone have been described, the osteoplastic (bone-forming) and the osteoclastic (bone-destroying). Both forms occur in connection with carcinoma of the breast. To quote Ewing: "The osseous invasion is sometimes very widespread and about 14 per cent (Kaufman) show osteoplastic changes." The most frequent occurrence and extensive distribution of the osteoplastic type of bone metastasis occurs secondary to carcinoma of the prostate. This form of metastatic carcinoma is identified by irregular areas of transparency intermingled with spots of new osseous formation giving rise to islands of increased density, often giving the bone a coarse mottled appearance. The osteoclastic form of bone metastasis is characterized by irregular areas of bone destruction usually beginning as a central focus of destruction in the marrow of the bone. As a rule the cortex is not involved until the later stages of the disease. However in the presence of known primary carcinoma, a negative examination is not absolutely conclusive, since the metastatic areas may be too small, or may not have produced a sufficient amount of bone destruction to cast a shadow on the roentgenogram. On the other hand, a positive finding makes the diagnosis certain.

All advanced cases of carcinoma of the breast should have a roentgenographic examination of the osseous system before treatment is started. If it is too expensive or difficult to examine the entire skeleton, then those parts should be included where metastasis most frequently occurs, namely the chest, spine, and femora.

The method of choice in the treatment of all advanced cases of carcinoma of the breast when there is as yet no evidence of skeletal metastasis is efficient roentgenotherapy combined with surgical removal of the primary growth, if operation is not contraindicated. Radiation can in no way produce a cure in cases with distant metastasis, but the metastatic areas may be kept under control for varying periods of time. One is justified in believing that when a large portion of the disease is rendered stationary or regressive the patient is better able to combat the remaining metastases.

Levin has demonstrated that the most important effect of radiation consists in the formation of an extensive connective tissue stroma surrounding and compressing the tumor cells. Pathological studies by Levin in cases of skeletal metastasis show this stroma to be transformed into bone. The literature contains abundant proof of the sensitiveness of cancerous cells to radiation and need not be established here.

During the past two and a half years 7 cases of primary carcinoma of the breast with secondary cancerous deposits in the bones have been observed. Two of these cases were given roentgen-ray treatments with marked improvement in general health, and life has been prolonged with relief from the distressing symptoms. One case is illustrative and is of sufficient interest to warrant its report in detail.

CASE REPORT

Mrs. O. W. G., aged thirty. Patient had ordinary diseases of childhood. Mother of two children, five and nine years of age. The health of the patient was always good until September, 1918, when she became very nervous; the nervousness increased progressively until September, 1919, at which time she underwent an operation for goiter.

Present illness: A lump about 4 by 3 cm. was noticed in the right breast for the first time two weeks before operation. Nipple was slightly retracted. Operation, November 22, 1921. Surgeons note: "Removal of right breast with glands in axilla and subclavicular space." Microscopic report: "Carcinoma with metastasis to glands." Unfortunately we were unable to obtain any further information regarding the history, and the type of the primary carcinoma was not given.

Following operation, patient remained in fair health until January, 1923, when she began having pain in the back which was diagnosed as rheumatism. The pain was partially relieved

FIG. 1. The arrows point to several areas of irregular bone destruction in the skull.

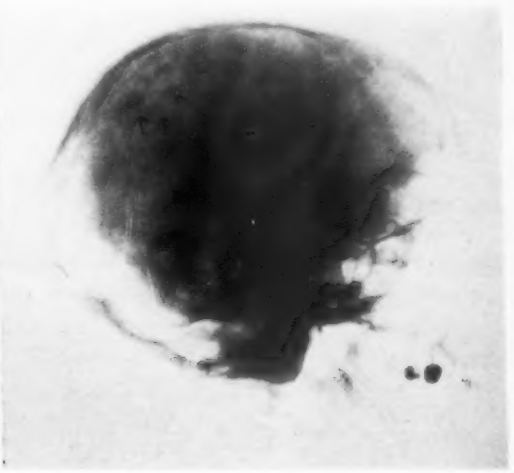

FIG. 2. Roentgenogram of skull ten months following first treatment. Note areas of irregular destruction intermingled with spots of osseous formation, giving rise to islands of increased density.

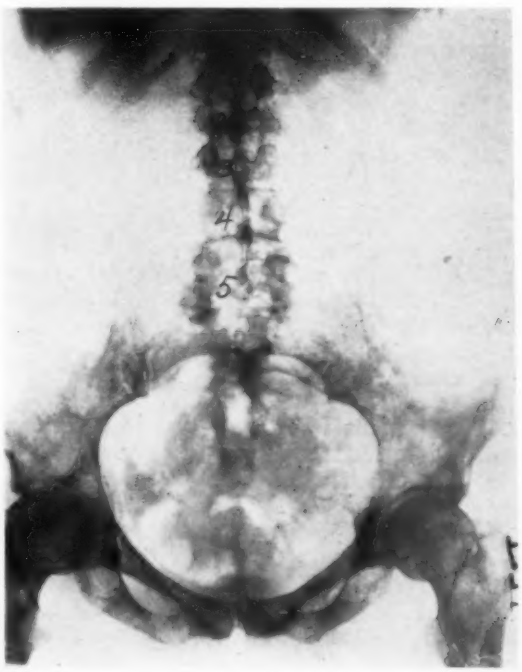

FIG. 3. Anteroposterior view of pelvis and lumbar spine on admission, showing extensive metastatic carcinoma (osteoclastic) involving these bones.

FIG. 4. Lateral view. Compare with Figure 3. There is extensive involvement of the vertebral segments, especially eleventh and twelfth dorsal, first and second lumbar vertebrae. Note the almost complete destruction of the second lumbar vertebra.

for a short time following strapping of the back. In October, 1923, several teeth were extracted and tonsils removed, with no benefit. Shortly after this she developed distressing symptoms referable to the epigastrium. The patient was referred for roentgen examination of the stomach Dec. 26, 1923. No organic lesion was found in the stomach. She complained of such intense pain in the cervical region that it was impossible for her to move the neck without turning the entire body. She was very dyspneic, cachetic and weighed only 83 pounds.

irregular destruction. Roentgenograms of the dorsal, lumbar spine and pelvis revealed extensive areas of bone destruction. Note the marked narrowing of the vertebral segments in the vertical plane, with almost complete destruction of the bodies of several vertebrae, especially the second lumbar segment (Figs. 3 and 4) while the discs are nearly intact. This is most characteristic of malignancy in this region, and is in contrast to tuberculosis of the vertebrae, in which instance the discs as well as the bodies are destroyed.

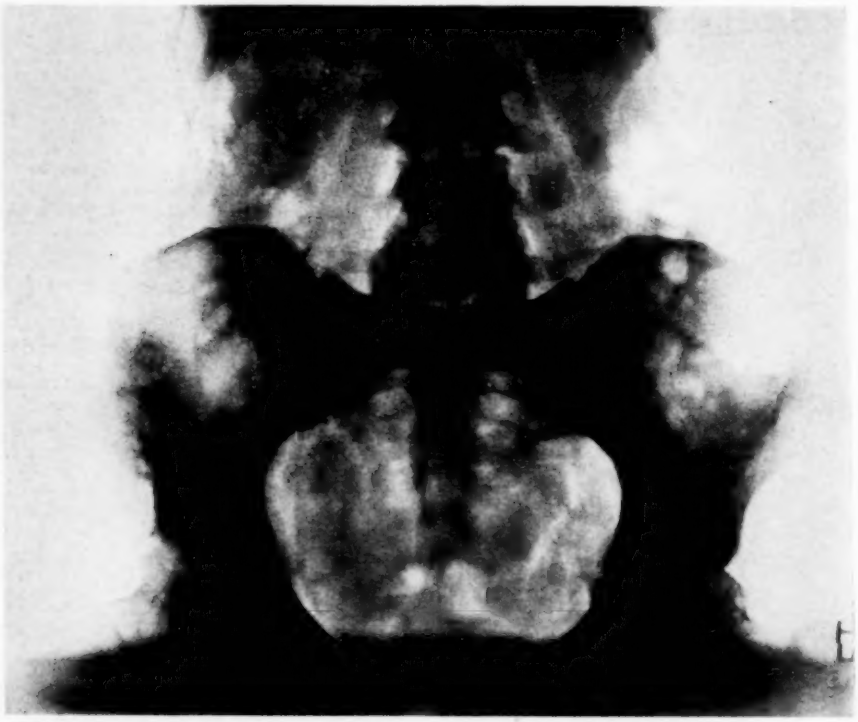

FIG. 5. Anteroposterior view of pelvis and lumbar spine ten months following treatment. Note that the irregular areas of rarefaction are replaced by new bone, and only traces of the larger areas remain.

Physical examination at this time disclosed a lump 2.5 cm. in diameter in the right axilla. No other nodules were detected. There were no skin nodules present. The poor physical condition of the patient and the not infrequent association of rheumatic pains in the presence of primary carcinoma metastasizing to the osseous system, led us to make a roentgenographic examination of those regions where metastasis most frequently occurs, namely, the chest, spine, pelvis, and skull. The physical condition of the patient would not permit a detailed examination.

The roentgenograms of the chest showed no evidence of lung metastasis. Those of the skull (Fig. 1) showed several extensive areas of

The patient was considered incurable, and palliative treatment was administered. The treatment consisted of small fractional doses over long periods. The technique used in this case was 15 per cent skin erythema doses of high voltage (200 kv.) roentgen rays filtered through 0.5 mm. Cu, at a focal skin distance of 50 cm. The areas treated were the chest, right axilla, spine, pelvis and both cervical regions.

Four months following first visit the patient showed marked improvement, getting around quite comfortably without pain. She gained 11 pounds in weight and felt well enough to take a hundred and fifty mile automobile trip. At this time she was given one-half

erythema dose of high voltage roentgen rays (200 kv.) over both cervical regions.

Five and one-half months after first treatment patient was able to move the neck more freely with little discomfort. She does her own housework and drives her machine to Cleveland for treatment, a distance of thirty miles. Further roentgenograms of the spine, pelvis and skull reveal marked improvement in the appearance of the bone structure, as evidenced by the extensive bone destruction in the pelvis and spine, being filled in with denser bone (Fig. 5) giving it a somewhat mottled appearance. The skull (Fig. 2) shows areas of irregular destruction intermingled with spots of condensation, giving rise to islands of increased density. Roentgenograms of the remaining skeleton reveal typical areas of destruction in the condyles of the right femur and head of the tibia. The scapula, bones of the arm and the forearm and right leg were negative as far as could be made out.

The patient continued to improve and had gained 27 pounds at the end of 7 months. She could now move her neck without pain. At this time 15 per cent erythema doses of high voltage roentgen rays were given at 7 to 10 day intervals, extending over a period of four months, covering the skull, entire trunk, upper ends of the femora and humeri. During this course of treatments the patient developed recurrent skin nodules in the scar, which responded to erythema doses of low voltage roentgen rays. She also complained of pain in the femur near the knee. A roentgenogram disclosed a rather typical carcinomatous area of destruction (Fig. 6) in the femur. Divided high voltage roentgen rays were given with relief of pain. The general health of the patient continued to improve and she continued with her household duties. In December, 1924, she weighed 116 pounds (33 pounds more than at the first visit in December, 1923).

During January, 1925, thirteen months following first visit she developed influenza, complaining of intense pain in the chest, spine, and pelvis. Naturally she believed this a return of the old condition, but the patient was seen again in April, three months following the influenza, and stated that she felt better than for several years.

On admission this patient presented the picture of a most hopeless case, but she remains clinically well sixteen months following first treatment. It is impossible to state how long the life of this patient will be prolonged, but the result in this case is sufficient to encourage further attempts with small fractional doses of roentgen rays. The treatment should be continued over a long time at stated intervals and should not be interrupted too soon, because the metastatic tumor may again become active, destroying a large portion of bone and the subsequent radiations may be of little value.

SUMMARY

1. Secondary deposits of cancer may spread to the bone by dissemination in the blood stream, by lymphatic embolism, and by lymphatic permeation.

2. Secondary cancerous deposits in the bone occur more frequently than is generally recognized.

FIG. 6. Note area of metastatic carcinoma in lower third of femur.

3. The distal bones below the elbows and knees occasionally show extensive involvement.

4. Rheumatic pains in the presence of known primary carcinoma should always suggest secondary cancerous deposits in the bones, and call for a thorough roentgen examination of the skeletal system.

5. The prognosis of osseous metastasis is always grave, but not entirely hopeless, and life may be prolonged for several months or even years, with relief from the distressing symptoms after the metastatic condition has become quite extensive.

6. The treatments should be fractional doses continued for long periods.

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THE USE OF CORPUS LUTEUM TO PREVENT NAUSEA IN RADIATION THERAPY OF UTERINE CONDITIONS*

A PRELIMINARY REPORT

BY ROBERT H. LAFFERTY M.D., AND C. C. PHILLIPS, M.D.

CHARLOTTE, NORTH CAROLINA

THE question of radiation sickness has for years aroused considerable discussion, and the problem has not yet been solved.

In considering our cases we find that the condition occurs more frequently and more severely in women than in men. We have seen some benefit derived from alkalinization and from the proper direction of diet, but in our cases of uterine conditions neither of these measures has been a decided success. The nonmalignant cases seem to suffer more from this condition than the malignant ones. This is probably due to the fact that many of these patients are younger and the ovaries more active in their internal secretory function, although the age does not seem to play any part in the readiness with which they respond to the administration of corpus luteum.

After having observed the benefit derived from the use of corpus luteum intravenously in those suffering from nervous and emotional symptoms following the production of artificial menopause by irradiation and also in some cases of vomiting of pregnancy, we determined to try its use in patients while under treatment, thinking that the action of the rays on the internal secretion of the ovaries might be partially responsible for the condition.

We have treated 16 cases, ranging in age from twenty-five to forty-five years. Ten were entirely relieved, 4 were improved and 2 were unimproved. One of the unimproved patients was twenty-five years of age, the other forty-five.

All of these 16 patients were known to become very much nauseated following small doses of roentgen rays, when corpus luteum was not used. Some of those listed as completely relieved were given the extract on alternate treatments and each time it was not given they were very much nauseated.

We administer usually only 1 c.c. intravenously immediately after treatment, but in some patients 2 c.c. are required to produce results.

We are fully cognizant of the fact that this is not a sufficient number of cases from which to draw definite conclusions, though we feel that the results obtained are encouraging, and the method worthy of consideration.

After observing the benefits derived from this method we have thought it possible that extracts of some of the other ductless glands might be of benefit in the prevention of this very annoying condition. We have not as yet had the opportunity of investigating this.

* Read at the Twenty-sixth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Washington D. C., Sept. 22–25, 1925.

ROENTGEN-RAY TREATMENT OF THE BOWEN TYPE OF SKIN CANCER*

BY H. H. HAZEN, M.D.

WASHINGTON, D. C.

IN 1912 Bowen[1] described a precancerous lesion that was characterized by a superficial plaque, with either a nodule, keratosis or fungous tumor springing from this plaque. The histopathology was characteristic. From time to time there have appeared various studies by Bowen,[2] Darier,[3] Morrow and Lee,[4] Rasch,[5] Ketron,[6] Korsbjerg,[7] Mount,[8] Sequeira and Turnbull,[9] Arzt and Biach,[10] and others. Ducrey[11] has contributed a monograph.

As a result of these studies our conceptions of Bowen's disease have materially widened. Most noticeably have been included small, waxy, slow-growing nodules that did not spring from an obvious plaque. There has also been a tendency toward confusion with Paget's disease,[12] certain well-known dermatologists considering the two identical.[13]

These lesions are probably very much commoner than the rather scanty literature would indicate, for within two years there have been nine examples of this disease in my office. Apparently the condition is a little more common in women than in men, and occurs chiefly if not entirely in those past forty years of age. The vast majority of the patients affected have had sandy complexions, with light brown hair, freckles, and a dry, non-elastic skin.

The lesions are usually multiple, varying in number from three to a dozen, and are most apt to occur upon the trunk, arms, and neck, although no part of the body is exempt. In the majority of instances the keratoses or malignant nodules spring from plaques, which may have been present from one to forty years. Upon rough examination there are apparently two types of plaques, the small, which somewhat resembles a chronic patch of psoriasis, and the large which is absolutely characteristic. However the two frequently coexist, and I have seen a small patch turn into a large one. In many instances it is impossible to diagnose a small plaque by physical examination alone, although the slowly increasing size, the sharp edge, the dry character, the permanency and a slight amount of induration may make one suspicious. Once malignancy has begun there is a waxy appearance. When the skin is put upon a stretch this is absolutely characteristic. The small plaques but rarely show a raised whitish border.

The large plaque is round or ovoid in shape, and varies in diameter from one to six inches. There is always a raised edge, sometimes double walled so as to remind one of porokeratosis. This edge is waxy in color when the overlying skin is stretched. The color of the patch is apt to be a deep red, but in long-standing cases may be light or atrophic. The center of the patch shows very little, if any, induration. The skin somewhat resembles a lichenification, but there may be one or two small nodules present.

The keratoses usually develop late, and from the edges rather than from the center of the plaques. They are usually very pronounced, and may be single or multiple. In diameter, they rarely exceed one-third of an inch, and they are infrequently elevated more than one-half inch.

The cancers arising from the plaques are of the basal cell type, and are exceedingly slow growing. Years are usually required before a diameter greater than one-half inch is reached. A number of neoplasms may arise from one of the larger plaques. In the vast majority of instances the new growths are either nodular or fungating, and are most apt to arise from the edges of the plaque; metastases do not occur.

Histologically there is a dyskeratosis; small patches of keratinization may occur in the upper layers of the rete. Many of the rete cells show marked vacuolization. The rete pegs are sometimes prolonged and pointed and sometimes club shaped. The

*Read at the Twenty-sixth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Washington, D. C., Sept. 22–25, 1925.

basal cells at the depths of pegs may show a marked proliferation, frequently cancerous, and then have an intense basophilic character, thus disproving the views of Borrmann[14] namely, that cancer springs from the adnexa.

The differential diagnosis can be the subject of much dispute. The chief difficulty arises from a failure to differentiate extramammary Paget's disease. Apparently the latter condition is much less dry, does not show the characteristic raised edge, and gives rise to a more serious type of malignancy. The literature upon the entire subject is most confused. The smaller plaques may readily be mistaken for the lesions of psoriasis, but a careful history and examination will usually permit one to make a diagnosis. Biopsy may be of the greatest aid.

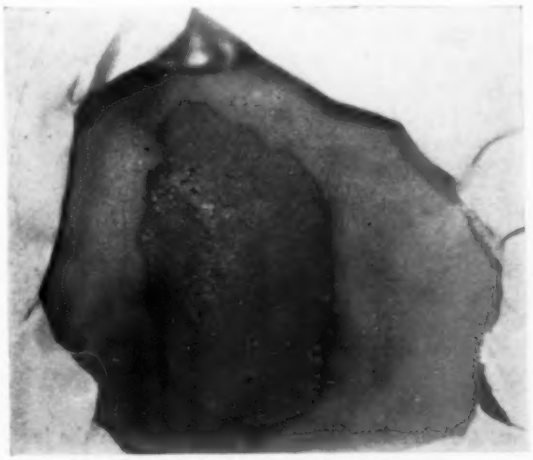

FIG. 1. A typical Bowen plaque. Case v.

There is a marked general belief that neither radiation nor irradiation has any marked value, but that the lesions are best treated by desiccation, cauterization, curettage or excision.

CASE REPORTS

CASE I. A white woman, aged seventy, has now been under observation for five years. She had the typical light brown hair and very dry skin already described. During the time of her visits there were 30 malignant growths, all save two of the small superficial nodular variety. There was one fungating tumor over the fifth dorsal vertebra. While under observation, a typical patch of irritant dermatitis appeared just over the iliac spine. This itched intensely, had an ill-defined edge, early fine scaling and was an absolutely characteristic dermatitis. One-quarter unit dose of roentgen rays caused such an alleviation of symptoms that she did not reappear for six months. By that time there was a large plaque some 4 inches in length. The location of the nodular lesions was as follows: Forehead 2; temples 2; cheeks 3; chin 2; neck 5; trunk 8; arms 4; axillae 2. Irritation was apparently a predisposing cause to many. All lesions have healed under a 1½ unit dose of unfiltered rays. A most intense telangiectasia has developed in the axillae and upon the neck, at the site of the small, treated areas. No lesions have recurred.

CASE II. White male, aged sixty-five, of the same sandy haired type but with only moderately dry skin, showed 3 lesions, located near the first lumbar spine, upon the abdomen near the umbilicus, and one on the right arm near the elbow. The latter was not over one-half inch in diameter, while the other two were about three times that size. A fungous tumor had developed from the edge of the plaques upon the back. Five treatments each of 2 unfiltered units were required to eradicate these plaques. After 3 treatments there was a partial recurrence of the edge of the plaques.

FIG. 2. A small plaque with a keratosis. Case III.

CASE III. A white woman, aged seventy, with markedly dry skin, had a typical plaque, without raised edge, about one inch in diameter upon the right forearm near the elbow. There was a keratosis at one edge. Three roentgen treatments of 1½ units resulted in a cure that has lasted over two years.

CASE IV. A white woman, aged seventy-five, with moderately dry skin, had suffered from 7 lesions for many years. There was a plaque about 3 inches in diameter in the right popliteal space, a fungous growth, about an inch in

diameter over the tenth dorsal vertebra, and five small plaques upon the arms. Only the largest one showed raised edges. With the exception of one growth upon the arm, where the cautery had to be used, all cleared up from 4 roentgen-ray treatments of 2 units each. Six months later the patient died from pneumonia, so the final result could not be determined.

CASE V. A white woman, aged sixty, with a mild xeroderma, had a plaque about 6 inches in diameter just above the left iliac crest. This had been present about twenty years, and had not been affected by mild irradiation. As the result of 4 treatments, the first two of 1¾ units, and the others of 1½ units, the edges disappeared, the itching stopped, and the lesion was nearly healed. After a period of six months there was no recurrence.

CASE VI. A white man, aged sixty, of a marked "sandy haired type" and with moderately dry skin had a plaque about one inch in diameter upon the right arm. This disappeared after 2 treatments of 1¾ units each, and has remained well nine months.

CASE VII. A white man, aged fifty-five, with a severe xeroderma, had 5 lesions of many years' duration. There was a small plaque upon the abdomen, one with a diameter of about one inch over the twelfth dorsal vertebra, and one each on the inner surface of the right thigh, over the left sterno-clavicular articulation, and on the left forearm. After 4 irradiation treatments it was found necessary to desiccate the lesions upon the abdomen, chest, and arm.

CASE VIII. A white woman, aged fifty-eight, had suffered for years with a plaque about 5 inches in diameter in the right supraclavicular area. In the center of this plaque was a deep cancer, about ¾ of an inch in diameter in the left supraclavicular fossa. There were 4 small plaques upon the chest, one just below the umbilicus and two upon the back between the shoulder blades. As a result of 3 roentgen treatments, all lesions have disappeared, but the case is still recent. This patient had no xeroderma.

CASE IX. A white man, aged seventy-five, without a xeroderma has recently come under observation with a plaque nearly 2 inches in diameter over the fifth lumbar vertebra. This has been present for years.

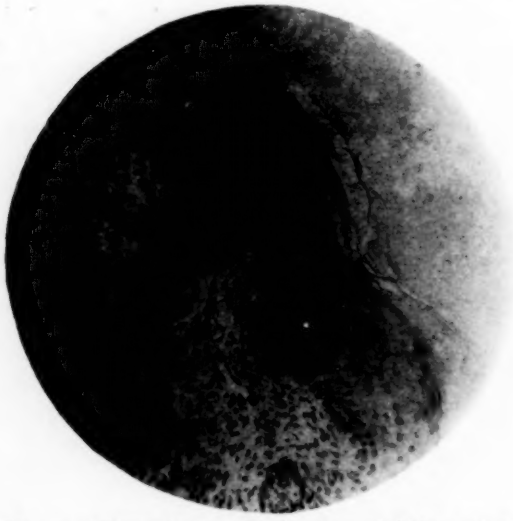

FIG. 3. Photomicrograph showing clubbing of the papillae, degeneration in the rete, a thickening of the basal cell layer, and reaction in the corium.

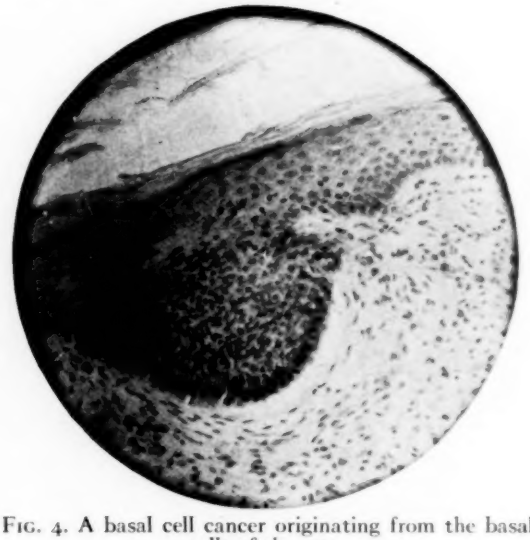

FIG. 4. A basal cell cancer originating from the basal cells of the rete.

SUMMARY

A total of 9 patients, 4 males and 5 females have been observed. Seven of the patients had congenitally dry skin. There was no family history of Bowen's plaques.

The nine patients showed a total of 58 lesions. The following table shows the distribution of the various types of lesions.

	Chest	Abdomen	Back	Neck	Face	Arms	Legs	Total
Large plaques	2	4	2	...	...	...	2	10
Small plaques	5	1	2	...	...	5	...	13
Nodules	5	...	5	5	9	4	...	28
Fungating tumors	...	...	3	...	...	...	...	3
Keratoses	...	...	...	...	...	4	...	4

A histological study shows that the plaques are cancerous from the beginning, hence they should not be classified as precancerous, as Heimann[15] has well pointed out. The malignant cells arise from the basal cells of the rete.

The tumors grow very slowly and only exceptionally are of a serious character.

Chronic irritation probably plays a very important part in the development of the disease.

The nodules and the fungous tumors respond brilliantly to irradiation. The small plaques usually heal very well, but the large plaques and the keratosis are frequently very resistant.

The following table shows the results obtained.

	Readily Cured	Cured with Difficulty	Resistant
Large plaques	2	8	
Small plaques	4	7	2
Nodular	28		
Fungous tumors	3		
Keratosis	1		3

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Information of interest to all readers will be found on page iii. Lists of officers of The American Roentgen Ray Society and The American Radium Society will be found below.

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EDITORIALS

PNEUMOCONIOSIS

THE paper on "Pneumoconiosis" by Pancoast and Pendergrass published in this issue of the Journal is the most complete review of the pathological and roentgenological aspects of this subject that has ever been published in this country. It will be found of value by all who are called upon to diagnose or treat diseases of the lungs, and of especial value to roentgenologists, since the roentgenological findings are largely depended upon for the diagnosis and determination of the stage of the disease. A complete consideration of the condition is especially desirable because it is almost entirely omitted from most textbooks on medicine.

The authors prefer "pneumoconiosis" as a general descriptive term, and "siderosis," "anthracosis," etc., to designate conditions arising in special industries. Silica, SiO_2, is, however, the active harmful agent in all industries, even among coal miners, potters, etc., and "silicosis" is often used instead of pneumoconiosis. The naked eye appearance of a dusty atmosphere is no criterion as to the damage producing properties of the dust. The very small particles of silica are the most dangerous and respirators are therefore of little use as a preventive measure. The occupation is dangerous in proportion to the amount of silica contained in the rock. Among the most dangerous occupations is granite cutting but there is a marked hazard among "potters, sand paper makers, tool grinders, metal polishers and grinders, brick makers, especially firebrick, and occupations in which sand blasts are used." Hard rock mining is also a dangerous occupation, especially gold, copper, zinc, lead, silver, nickel and cobalt. More silica is found in anthracite than in bituminous mines and anthracite mining is therefore the more dangerous. There is considerable danger of contracting the disease even by people who live in sandy regions where wind storms are prevalent.

The preventive measures that have been found of use are spraying after blasting and other uses of water to prevent dust in the atmosphere, cleanliness in industries to prevent accumulation of dust forming waste, ventilation to remove unlaid dust, and in mines to have blasting done between shifts, and not allowing workmen to enter the area until an interval of one-half hour has elapsed after the blasting.

The writers have arranged the pathological features under the following headings, each of which is thoroughly discussed: (1) the entrance of dust; (2) the "dust cell;" (3) the entrance of the "dust cell" into the lymphatic system; (4) the subsequent conversion of the "dust cell" into fibrotic tissue, (5) the elimination of dust, and (6) the predisposition of the fibrotic lung to respiratory infection.

The clinical stages of the disease follow very closely the roentgenological appearances and the authors have adopted the classification of stages first made by Lanza and Childs in 1917. They give detailed descriptions and illustrations of the roentgenologic findings in each of the three stages.

The following quotation contains an admonition that has been emphasized many times in these pages:

"Roentgenologic interpretations of any morbid process in the lungs must be based upon a thorough knowledge of the anatomy and histology of the lungs and the pathological processes peculiar to the infecting or etiological agent. One must acquire the habit of thinking in terms of pathology and rendering deductions upon a pathological basis, because he is interpreting the shadows of disease processes. Lung histology has been most clearly demonstrated by Miller, and every roentgenologist should be thoroughly familiar with his

graphic and concise descriptions." One of Miller's articles on the anatomy of the lungs was published in this Journal in the June, 1917, number and is listed with others by the same author in the extensive bibliography following Pancoast and Pendergrass' paper.

An important point which is adequately emphasized in this article is the quite thoroughly demonstrated fact that pneumoconiosis predisposes to tuberculosis of the lungs. Re-emphasis of this fact is important in order that preventive measures may be instituted and also because reports to the contrary are made from time to time. Lately a German report with statistics purports to show that tuberculosis is actually less common among those suffering with pneumoconiosis than among the remainder of the population. Pancoast and Pendergrass show by their own experience and the collective reports of nearly all writers on the subject that pulmonary tuberculosis is a very common disease among those who have the lung changes of pneumoconiosis.

THE UNIT OF RADIATION

The demand for an absolute unit of radiation is felt by all radiologists. The biological units, such as the "skin erythema dose," is most unsatisfactory. As has been shown by Béclère, this dose may vary as much as 1 to 3.9, or, in other words, one author may have in mind almost four times the amount of radiation of another in speaking of a skin erythema dose.

The "ionization unit" has unquestionably been demonstrated as the best, and our reports, when possible or practical, should utilize these absolute ionization units to designate the dosage. Such a unit was described by Villard in 1908 as "that quantity of rays which, by ionization, produces one electrostatic unit per cubic centimeter of air, in normal conditions of pressure." Duane has elaborated methods of making these measurements, and refers to this unit as "E." This unit corresponds to the unit adopted by the Standardization Committee of the German Roentgen Society at Bonn, May 29, 1925, in which they designate this unit as one "Roentgen," or abbreviated as "R," this unit having been presented by the German physicist, Behnken. Solomon, a French physicist, in 1921 presented an ionization unit, standardized by means of radium, because of the constancy of radium the world over, which he also called one "Roentgen" and abbreviated "R." 1 Behnken (German) "R" = 2.25 Solomon (French) "R." If these units are sufficiently designated as German "R" or French "R," it is an easy matter to calculate the values in either one. It would seem, therefore, that without any formal or parliamentary action, the United States, Germany and France are already using a definite and absolute ionization unit. It is only necessary to designate the unit properly and make a single calculation, until the physicists determine whether the constant element, radium, shall be used as the means of standardization, or whether the more complicated conditions shall be utilized for the standard. We have made progress.

G. E. PFAHLER.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY *visiting New York City, are invited to make the office of* THE JOURNAL *(69 East 59th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES

WE contemplate the publication of a list of roentgen society meetings such as that below, in each issue of the Journal, gradually adding other home and foreign societies as the information reaches us. Secretaries of societies not here listed are requested to send the necessary information to the editor.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Eugene V. Powell, 217 East 42d St.
Meets monthly on second Monday, New York Academy of Medicine.

THE CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.
Meets annually.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

THE NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Charles W. Blackett, 35 Bay State, Rd., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Edward S. Blaine, 2005 S. Wabash Ave.
Meets monthly on second Friday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. E. P. McNamee.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. C. J. McCullough, Decatur, Illinois.
Regular meetings held quarterly.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Torino, Torino.

THE BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London; W. 1.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medcine, 1 Wimpole St., London, W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Meets in Copenhagen.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Meets in Amsterdam every second month except in the summertime.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prag, 11/52.
Annual Meeting in Prag the last week of October.

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Robert J. May, St. Luke's Hospital, Cleveland, Ohio.
Annual meeting, Cleveland, Ohio, December 7–11, 1925.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. M. J. Hubeny, 25 E. Washington St., Chicago, Ill.
Annual meeting, Dallas, Texas, April 19–23, 1926.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Annual meeting, Dallas, Texas, Nov. 9–12, 1925.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

PRELIMINARY PROGRAM ELEVENTH ANNUAL MEETING RADIOLOGICAL SOCIETY OF NORTH AMERICA, CLEVELAND, OHIO, DECEMBER 7–11, 1925

SYMPOSIUM

SYMPOSIUM ON LYMPHOBLASTOMA

LEADER, A. U. DESJARDINS, M.D.

"Duration of Malignant Lymphoma and the Early Abdominal Symptoms." GEORGE MINOT, M.D., Boston.

Title to be announced. W. S. STONE, M.D., New York.

"Radiotherapy in Lymphoblastoma." ARTHUR U. DESJARDINS, M.D., Rochester, Minn.

SYMPOSIUM ON BONE TUMORS

LEADER, ALBERT SOILAND, M.D.

"The Pathology of Bone Tumor." D. B. PHEMISTER, M.D., Chicago.

"A Roentgenological Study of Bone Tumor." HOWARD E. RUGGLES, M.D., LLOYD BRYAN, M.D., San Francisco.

"The Surgical Aspect of Bone Tumor." H. W. MEYERDING, M.D., Rochester, Minn.

"Radiation in the Treatment of Bone Tumor." ALBERT SOILAND, M.D., Los Angeles.

SYMPOSIUM ON CHILDREN

LEADER, W. W. WASSON, M.D.

"An *X*-Ray Study of the Development of the Ossification Centers of the Skeletal System." BUNDY ALLEN, M.D., Iowa City, Ia.

"Cyclic Vomiting in Children." LEON T. LEWALD, M.D., New York.

"The Influence of Infection upon Development of the Accessory Nasal Sinuses." T. E. CARMODY, M.D., Denver.

"*X*-Ray Diagnosis of Pulmonary Tuberculosis in Children." JOHN D. MACRAE, M.D., Asheville, N. C.

SYMPOSIUM ON CHEST DIAGNOSIS

LEADER, W. I. LE FEVRE, M.D.

"A Demonstration of the Main Points in the Technic of Chest Radiography." W. W. WASSON, M.D., Denver.

"Syphilis of the Lungs." C. R. ORR, M.D., Buffalo.

"The Use of Iodized Oil in the *X*-Ray Diagnosis of Lung Cavities." JACQUES FORESTIER, M.D., Aix-les-Bains, France.

SYMPOSIUM ON KIDNEY DIAGNOSIS

LEADER, C. D. ENFIELD, M.D.

"The Interpretation of the Pyelographic Shadow." B. H. NICHOLS, M.D., Cleveland.

"The Normal Ureter from the Pyelographic Standpoint." D. R. EISENDRATH, M.D., R. A. ARENS, M.D., Chicago.

"Differential Diagnosis of Urographic Shadows from the Urologist's Standpoint." OWSLEY GRANT, M.D., Louisville.

SYMPOSIUM ON GALL BLADDER DIAGNOSIS

LEADER, SHERWOOD MOORE, M.D.

Title to be announced. ARIAL W. GEORGE, M.D., Boston.

"Gall Bladder Diagnosis from the Standpoint of the Surgeon." EVARTS A. GRAHAM, M.D., St. Louis.

"The Diagnosis of Gall Bladder Disease from the Medical Standpoint." B. B. VINCENT LYON, M.D., St. Louis.

"A Clinical Study of Cholecystitis with Cholecystography." OSCAR C. ZINK, M.D., St. Louis.

SYMPOSIUM ON TOXIC GOITER

LEADER, B. H. NICHOLS, M.D.

"Surgical Treatment of Goiter." GEO. W. CRILE, M.D., Cleveland.

"Indications for Surgical Treatment of Goiter." FRANK H. LAHEY, M.D., Boston.

"*X*-Ray Treatment of Goiter." HENRY KENNON DUNHAM, M.D., Cincinnati.

"*X*-Ray Treatment of Goiter." E. L. JENKINSON, M.D., Chicago.

"The Heart and the Value of Basal Metabolism Estimations in their Relation to Diagnosis, Prognosis and Cure." BURTON E. HAMILTON, M.D., Boston.

"The Effect of Radiation upon the Histological Structures of the Thyroid Gland." ALLAN GRAHAM, M.D., Cleveland.

SYMPOSIUM ON NON MALIGNANT PELVIC CONDITIONS

LEADER, B. H. ORNDOFF, M.D.

Essayists and Titles to be announced.

"Chronic Mastitis, A New Treatment, with a Report of 150 Cases." FRANK E. ADAIR, M.D., New York.

"A Comparative Radiological Study of the Knee Joint by Pneumoarthrosis." M. L. BERNSTEIN, M.D., R. A. ARENS, M.D., Chicago.

"Carcinoma of the Cervix and Fundus Uteri Treated by a Combination of Surgery, Radium and *X*-Ray." HARRY H. BOWING, M.D., Rochester, Minn.

"The Effect of *X*-Ray on the Vitamin Needs of the Organism and Cancer." MONTROSE T. BURROWS, M.D., LOUIS H. JORSTAD, M.D., EDWIN C. ERNST, M.D., St. Louis.

"*X*-Ray Findings in Lobar Pneumonia." WEBSTER W. BELDEN, M.D., New York.

"The Clinical and Radiological Diagnosis of Cancer of the Stomach." GEO. B. EUSTERMAN, M.D., R. D. CARMAN, M.D., Rochester, Minn.

"Fractures of the Os Calcis." H. R. CONN, M.D., Akron, O.

"Roentgen Ray Examination of the Joints of Hemophilics." HOWARD P. DOUB, M.D., E. C. DAVIDSON, M.D., Detroit.

"Report of the Committee on Standardization of *X*-Ray Measurements." E. C. ERNST, M.D., Chairman, St. Louis.

"Radiological Exploration with Lipiodol." JACQUES FORESTIER, M.D., Aix-les-Bains, France.

"The Relation of the Roentgenologist and his work to the Surgeon." LOUIS FRANK, M.D., Louisville.

"Erythema Doses in Absolute Units." OTTO GLASSER, PH.D., New York.

"Diagnosis and Treatment of Bone Tumors." RALPH E. HERENDEEN, M.D., New York.

"Roentgen Therapy in Hypofunction of the Ovary." I. SETH HIRSCH, M.D., New York.

"Some Important Considerations in Planning an *X*-Ray Department." PRESTON M. HICKEY, M.D., Ann Arbor.

Title to be announced. HENRY HULST, M.D., JOHN H. MULLER, M.D., Grand Rapids.

"The Clinical Aspects of the Treatment of Diphtheria Carriers by Roentgen Rays." ETHEL D. HUMPHRYS, M.D., Denver.

"Leukemia." E. L. JENKINSON, M.D., Chicago.

Title to be announced. B. R. KIRKLIN, M.D., Muncie, Ind.

"A Report of the Treatment of Carcinoma of the Breast with Radium Emanation in Platinum Filter Needles." BURTON J. LEE, New York.

"Cholecystography by the Oral Method." LESTER LEVYN, M.D., A. H. AARON, M.D., Buffalo.

"Family Diverticulosis of the Colon." F. W. MACKOY, M.D., Milwaukee.

"Protection Standards against *X*-Ray Dangers." A. MUTSCHELLER, M.D., Long Island City, N. Y.

"The Necessary Liaison between Radiologist and Cardiographer." LEO E. PARISEAU, M.D., Montreal.

"The Relative Value of Various Techniques in the Radiation Treatment of Carcinoma of the Breast, as Reflected in the Statistical Analysis of 707 Private Cases." GEO. E. PFAHLER, M.D., B. P. WIDMANN, M.D., Philadelphia.

"Skin-microscopical Studies of the Roentgen-erythema." ERNST A. POHLE, M.D., Ann Arbor, Mich.

"Implantation of Radium Emanation in Gold Capillary Tubes." DOUGLAS QUICK, M.D., New York.

"A Comparison of Radium, Long Wave and Short Wave *X*-Rays in the Treatment of Carcinoma of the Uterine Cervix." HENRY SCHMITZ, M.D., Chicago.

"The Dead Fetus in Utero, A Clinical Radiological Study." IRVING F. STEIN, M.D., ROBERT A. ARENS, M.D., Chicago.

"Radiological Study of Osteitis." C. G. SUTHERLAND, M.D., Rochester, Minn.

"Diverticulum of the Stomach." HAROLD SWANBERG, M.D., Quincy, Ill.

"The Bio-Physical Effects from the Treatment of Diphtheria Carriers by Roentgen Rays." SANFORD WITHERS, M.D., Denver.

MOTION PICTURE FILMS

"Scientific Film 'Roentgen Rays.'" DR. FRIEDRICH VOLTZ, Munich.

(To Be Shown By DR. OTTO GLASSER)

"*X*-Ray Motion Pictures of the Thorax." HOWARD E. RUGGLES, M.D., San Francisco.

"Gastric Ulcers." LEWIS GREGORY COLE, M.D., New York.

PHILADELPHIA ROENTGEN RAY SOCIETY

The regular meeting of the Philadelphia Roentgen Ray Society was held Thursday evening, October 1, 1925, at the Pennsylvania Hospital, the meeting being called to order by the president, Dr. Widmann. There were twenty-eight members and guests present.

The newly elected officers for the ensuing year were installed, the officers being: Edward G. Meter, president; Albert G. Miller, vice-president; E. P. Pendergrass, secretary; Arthur C. Sender, treasurer.

The scientific program was then presented. Dr. Pancoast gave a very interesting and instructive talk on "Pneumoconiosis." An abstract of his talk is not included in these minutes as the original article is published in this number of the Journal.

A review of the Washington meeting of the American Roentgen Ray Society was presented by Drs. Bowen, Bromer and Pancoast.

Dr. Jackson presented some slides illustrating two changes in the styloid process of the radius associated with ununited fractures of the scaphoid. The first change is an absorption or atrophic change in the styloid process, and the second and final change is a hypertrophic change of the styloid process of the radius. Dr. Jackson feels that these changes account for the pain associated with the ununited fractures of the scaphoid.

Other interesting films were presented by Drs. Burtin and O'Boyle.

In the business session which followed, the society voted favorably upon a motion to cooperate with the roentgen ray societies of Boston and New York to arrange a mid-winter meeting at Altantic City, in view of the discontinuance of the mid-winter meetings of the Eastern Section of the American Roentgen Ray Society.

E. P. PENDERGRASS,
Secretary

To the Editor:

The writer has, for a long time past, often felt the need of a word to express fluid in the chest without the necessity of specifying whether it be, for instance, blood, serum or pus (hemo-, or pyothorax). Such a word seems to be particularly useful in the group indexing of these cases and we would suggest the word hygrothorax, from the Greek *hygros*, liquid or fluid.

The writer is indebted to Lt. Col. Garrison, of the Army Medical Museum and Library, for assistance in confirming the derivation of this term.

DAVID R. BOWEN, M.D.
Philadelphia, Penna.,
October 8, 1925.

DEPARTMENT OF TECHNIQUE

Department Editor: DAVID R. BOWEN, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

NEW OPERATING ROENTGENOSCOPE

BY ROBERT A. ARENS, M.D.

Roentgenologist, Michael Reese Hospital

CHICAGO, ILLINOIS

THE localization of a foreign body in relation to the adjacent osseous structures, its depth from the skin surface, etc. is obtained in a comparatively easy manner by any of the various methods usually employed when the foreign body is large and not deeply embedded. The removal can often be done by the surgeon without assistance other than a preliminary localization. When the foreign body is small or deeply embedded in the soft structures, or both, it is usually very difficult for the surgeon to retain his landmarks after the initial incision is made. He may lose his land marks because the tissues fall away to one side or the other, or are pulled out of relationship by the retractors of his assistants, or because he fails to make the incision along the line of what had been the central ray when the preliminary films were taken, or he fails to visualize or correctly interpret the films in the light of regional anatomy. Again, he may not be at fault. The roentgenologist or his assistants may not have taken a correct anatomical view of the part roentgenographed.

The necessity of frequently assisting the surgeon in the localization and removal of roentgen-opaque foreign bodies brought the realization that none of the usual methods was entirely satisfactory. Much might be said for and against the various methods employed in this work. A few instances probably will suffice. The triangulation methods may all localize a foreign body accurately, yet the work must be very carefully done or it is valueless, and since it usually depends for its primary landmarks upon skin markers, or markings, it usually is not accurate after the initial skin incision is made. The Hirtz compass is exceedingly accurate in its localization, but is open to the same objection. The Grashie monocle is difficult for the average surgeon to use on account of the necessity of keeping one eye in continual darkness, being covered by the monocle roentgenoscope, and operating by the use of the other eye which is in daylight. Furthermore, the roentgenoscopic screen is too far removed from the observer's eye to enable small particles to be seen clearly. The various types of operating head roentgenoscopes are all cumbersome, bulky and heavy, theoretically good, but highly impractical. The common fault of all present methods is that of not being able to properly sterilize that part of the roentgenoscope which may accidentally come in contact with the open wound. Even the use of a sterile towel or sheet over the end of the roentgenoscope is at best a makeshift only.

The "Joy-stick" method, a product of the war, undoubtedly holds first place as a method of choice. Its simplicity and accuracy recommend it. The writer's objection to it is not the method but the use of the roentgenoscopic screen in the manner in which it is used. The average screen is too large to start with, necessitating the surgeon working entirely under it. His hands, retractors, forceps, probes, etc., of necessity must come between the roentgenoscopic screen and the field of operation. This necessitates raising the screen to a considerable distance above the field to permit working under it. It is a well-known fact that the farther away the screen is from the object to be viewed, the more distorted and hazy it becomes, especially so when the object or foreign body is very small so that it is often extremely difficult to visualize clearly. It also makes it difficult to determine the

relative positon of the seeking forceps end or probe, and the foreign body. This holds true for all the present type of screens used for this purpose.

To obviate these difficulties the writer has devised a special operating roentgenoscope patterned somewhat after a hand mirror from which the idea was gleaned. In order to be satisfactory it should be constructed as follows: (1) It should be possible to sterilize it by any method available, including the use of steam; (2) it should permit the roentgenoscope to come in direct contact with the open wound without any fear or danger of contaminating the field; (3) it should be so small that forceps, scalpels, retractors, etc. can be used under it and from the side so that the foreign body can be readily grasped under conditions to permit of the best possible visualization; (4) ability to bring the roentgenoscope as close as possible to the sought for foreign body, even into the wound if necessary.

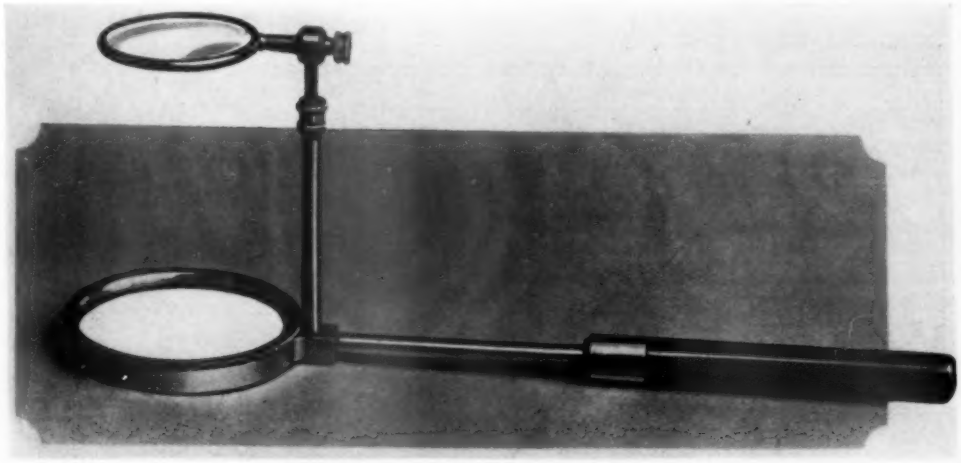

FIG. 1.

DESCRIPTION OF ROENTGENOSCOPE

The roentgenoscope is small and compact consisting of a round head piece or container for the roentgenoscopic screen, with a handle long enough to permit the screen being held in the field of the roentgen rays and the hands being entirely outside. The head piece is so arranged that the roentgenoscopic screen can be dropped into it and fastened by means of a large washer which screws down holding the screen tightly in place. The screen proper is faced by a heavy piece of lead glass and backed by a piece of aluminum which is spun over the glass in such a way as to make a reasonably tight joint, thereby permitting even the screen container to be sterilized by means of alcohol or some other antiseptic contact without damaging the screen. The handle screws into the head piece and is composed of two joints, one screwing into the other so that the equipment can be taken apart and carried in a very small package. A magnifying glass is included with the apparatus and is so arranged on a separate telescopic base that it can be raised or lowered to the proper point over the roentgenoscopic screen. This magnifying glass with its holder is attached to the head by the handle. It is a very simple procedure to take the magnifying glass off entirely and use the screen without it.

Figures 1 and 2 will give a far better idea of the extreme simplicity of this new roentgenoscope than a very minute description. I have used it in a large number of cases during the past year for the removal of foreign bodies, such as fragments of needles, nails, pins, chips of steel, small pieces of lead containing glass, etc. By its use the initial incision can be made so small that the mutilation which is frequently the result of foreign body removal can be entirely dispensed with. Needle

fragments projecting through the capsule of the knee joint, for instance, have been removed without injury to the joint, other foreign bodies likewise.

Our usual method of procedure is as follows: A film is first taken to ascertain the presence of a foreign body. No other localization is attempted. The patient is brought to the roentgenoscopic room and either a local or general anesthetic given. The foreign body is now tentatively localized for the easiest means of removal, and in this position a skin localization is made. The field is now properly prepared and an initial incision made to a suitable depth. A forceps is now placed in the wound, which in most instances need be only ¼″ long or a buttonhole incision, and by means of the operating roentgenoscope brought down in contact with the foreign body. A curved forceps works best. Of course it is understood that only a very small beam of light is used. The forceps is now moved around in such a way that the jaws come in contact with the object. At this time the surgeon is told to open the forceps and instructed how to move it until the foreign body is directly within the jaws. He is then requested to close the forceps and the foreign body is thus secured and easily removed. The only time that the room is in darkness is for a brief period in which the localization is done and the foreign body secured in the jaws of the forceps. The balance of the work is done entirely under operating light.

In our experience it is not uncommon to remove a needle in from one to two minutes after the initial incision has been made. We all know the extreme difficulty encountered in the removal of a needle, especially when its long axis lies in the axis of the tendons, especially of the hand or foot, and the surgeon is compelled to limit the strokes of the scalpel in one direction for fear of severing a tendon, nerve, vessel, etc. I have actually witnessed an attempted removal of a needle in the foot which took over five hours and was not successful. We have never yet failed to remove a foreign body, such as one gets in a routine practice, in less than five minutes. Small chips of steel 2–3 mm. in the largest diameter have been removed from the forearm within this time. Had it not been for the roentgenoscopic control it would have been impossible.

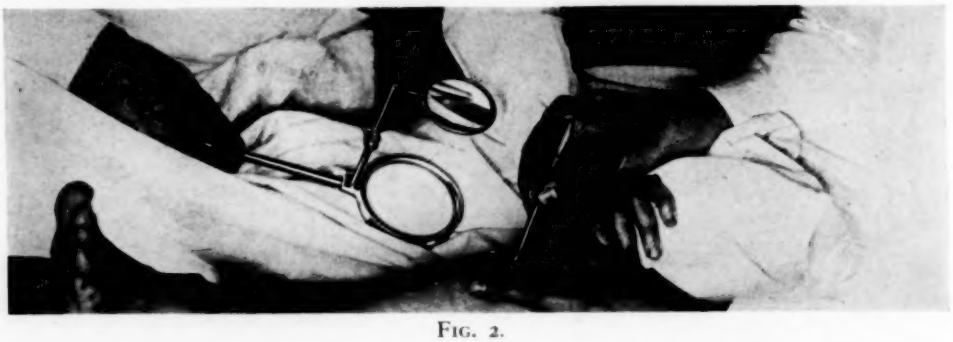

Fig. 2.

In conclusion, the following are what the writer considers to be distinct advantages of this new operating roentgenoscope:

(1) It is small, compact and take-a-part.
(2) It can be made up in any convenient size.
(3) It can be sterilized by any convenient method.
(4) There is no danger of contaminating the wound should the localizer come in contact with the operative field.
(5) A buttonhole incision through the skin is usually sufficient.
(6) As the result of a small incision there is no mutilation of the part.
(7) As the result of the small incision, asepsis, and perfect roentgenoscopic control there should be no untoward results such as entering a joint, unnecessary severing of tendons, nerves, vessels, etc. or infection.

MULTIPLE STEREOSCOPY

BY VERNOR M. MOORE, M.D.

GRAND RAPIDS, MICHIGAN

THE usual method of making stereoscopic roentgenograms consists in centering the tube directly over the part to be examined, then shifting the tube laterally or longitudinally as desired, making one exposure a certain distance at one side of the center and the other an equal distance to the opposite side in the same plane.

There are certain regions which are better studied by a lateral shift in making the stereo while others are brought out better by a longitudinal shift. Occasionally the same region can best be studied by a double set of stereos, one made with a lateral shift and the other with a longitudinal. The first method proposed introduces no new principles except the making of the double set of stereos, using three instead of four films. The second method makes three stereos on three films only but in the same plane.

The first method is as follows: The tube is centered directly over the part to be roentgenographed, and exposure marked 1 is made. The second exposure marked 2, is made after shifting the tube two inches laterally. The tube is now returned to the first position and from this point is shifted two inches, at right angles to the first shift, and exposure 3 made. The roentgenograms, 1 and 2, will stereo when viewed in the upright position, while 1 and 3 will stereo with the image placed horizontally.

The second method suggested can be used where a shift in one plane only is possible or desirable. The first exposure is made directly over the part to be roentgenographed. The second is made by shifting the tube laterally to the right for a distance of 2 to 3 inches. The third exposure is made after shifting the tube an equal distance to the left of the number one position. The films are marked 1, 2, and 3, respectively. Each stereo is viewed in the upright position; 1 and 2 will stereo, as will 1 and 3, and also 2 and 3, thus making three stereos from three films.

The first method has been found to be of value in injuries around the shoulder, the lateral shift revealing possible dislocations and fractures of all parts except the acromion process of the scapula. The longitudinal shift will reveal a fracture of the acromion process which might otherwise be overlooked. It can be used in many other regions when indicated.

The second method has been found to be of definite value in the roentgenographic study of the paranasal sinuses. By the usual methods of examination, the ethmoids are frequently obscured by superimposed shadows. The three sets of stereograms allow these shadows to be shifted so that practically all the ethmoids may be studied without difficulty. The films 2 and 3 give greater depth detail, so that the sphenoid can be seen surprisingly well. We are gradually extending this method to mastoids and to skull examinations, as well as to cases of suspected rib fracture, and are frequently finding new uses for it.

A partial survey of the literature has failed to show these methods described, although it is entirely possible that they may have been used. At any rate, it would seem that they merit consideration.

NOTE ON THE PREPARATION OF IODOFATS

BY L. BAUMAN, M.D., AND JULIA WOODFORD, B.A.

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NEW YORK CITY

LIQUID fats containing a relatively high amount of intramolecular iodine are being used in diagnostic roentgen-ray work, and for therapeutic purposes. Some months ago we were unable to obtain several hundred milliliters of this material which was required for roentgenographic purposes. By employing a modification of the Wijs[1] method for determining the iodine number of fats, we were able to prepare it in a fairly simple manner.

Thirteen grams of iodine were dissolved in one liter of 95 per cent acetic acid with the aid of heat. Chlorine was then passed into the solution until all the iodine had combined to form iodine-chloride (indicated by a change in color from brown to yellow); 60 gm. of poppy seed oil dissolved in 100 gm. of chloroform was slowly poured with shaking into the iodine-chloride solution. The shaking was continued until the whole was converted into an emulsion. On standing over night the heavy iodized oil settled to the bottom. The bulk of the acetic acid was decanted and the rest carefully separated in a separatory funnel. The oil was taken up in chloroform, filtered, and the chloroform evaporated off in a water bath. The acid adhering to the oil was removed by placing it in an evacuated desiccator over concentrated sodium hydroxide solution. This process required from four to seven days. The last traces of water were then removed by drying *in vacuo* over phosphorus pentoxide.

In five different trials we obtained yields of iodofat of from 62 to 66 gm. with an iodine content which ranged from 25.8 to 27.8 per cent.

[1] Wijs, *Ber. d. deutsch. chem. Gesellsch.* 1898, xxxi, 750.

Samples of the five batches, placed in test tubes, and a tube of the untreated poppy seed oil were tested for opacity to roentgen rays with the results shown in Figure 1.

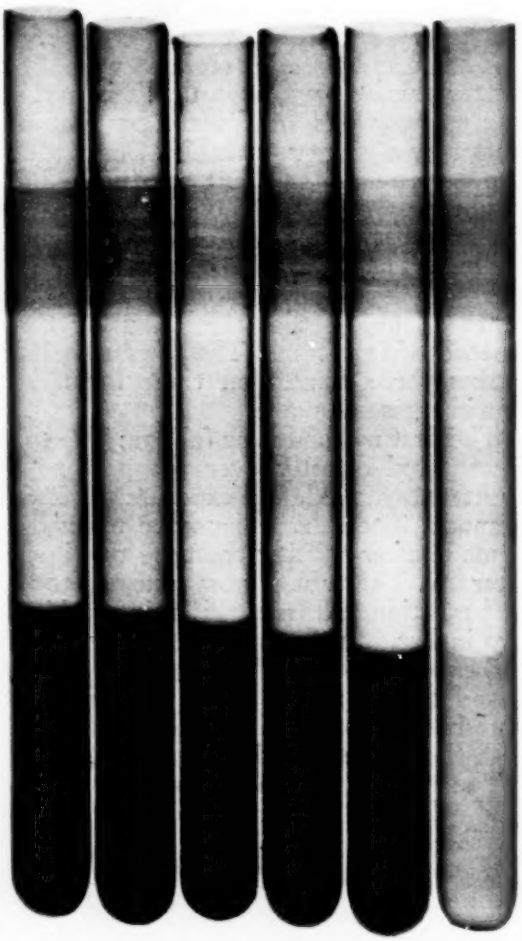

FIG. 1. Roentgenogram showing opacity of iodofat and untreated poppy seed oil (extreme right) to roentgen rays.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

RADIO ET CURIETHÉRAPIE EN CLIENTÈLE. By A. Kergrohen, Chef de Clinique et Lauréat de la Faculté de Médecine de Bordeaux; Médecin de la Marine. Licencié ès-Sciences. Paper. Pp. 391, with 74 illustrations. Paris: A. Maloine et Fils, 1924.

This work is in the nature of a manual on roentgenotherapy and curietherapy for the practitioner. It is divided into two parts, the technique of using the roentgen-ray apparatus and radium, and the therapeutic applications of both. The technical features of the apparatus used in roentgenotherapy are taken up only briefly, and the essential points are illustrated. The field is treated briefly, and seems to be meant for the practitioner who would take up this form of therapy without having detailed training in this field. It is a general discussion of the present methods of this therapy for the information of the practitioner, but not enough information is given to qualify the reader to make use of either the roentgen ray or radium.

The conditions for which this form of therapy is applicable are outlined and methods for treating them are given. Illustrations, diagrams and drawings are submitted for clarification of the descriptions given.

The author emphasizes the necessity for a thorough knowledge of physics and medicine before any attempts in roentgenotherapy and curietherapy be made. However, he implies that with such knowledge of physics and medicine, this manual would be an aid in the study and mastery of this subject. It is far too general and too elementary to be of much value, either to the practitioner, who will find the book inadequate, or to the specialist in roentgen- and curietherapy, whose knowledge of the subject far surpasses that given in this book. It is most useful, probably, to the young student of this subject, in that a brief presentation of the essential features of his study are given. It will also serve to give the general practitioner a fairly clear understanding of the principles and uses of this form of therapy.

G. F. REDDISH.

LES PRINCIPALES POSITIONS UTILISÉES EN RADIOGRAPHIE. By Dr. L. Delherm, Chef du Service d'Electro-Radiologie de l'Hôpital de la Pitié, and Dr. Morel-Kahn, Assistant du Service d'Electro-Radiologie de l'Hôpital de la Pitié. Paper. Price, 25 fr. Pp. 252, with 134 illustrations. Paris: A. Maloine and Fils, 1925.

This monograph is a rather complete compilation of the technique employed in roentgenography at the present time, as well as certain rarely used procedures for which certain advantages are claimed. The work consists of descriptions of the technique employed. Precise positions are indicated, necessary precautions given, and the roentgen findings tabulated. Photographs are given of each position of the subject accompanied by the roentgenogram obtained. In this way, a complete description is possible. The different parts of the body are taken up in some detail, and the roentgenograms discussed from the standpoint of their findings. For example, roentgenograms are taken of the head from different angles, profile, ventral, frontal, etc., and at different angles of the various positions. The same is true of other portions of the body, affording a systematic method of studying in detail the various bone formations from such positions as will give the maximum of information. A study of certain of the internal organs is also made, the best positions, etc. indicated and illustrated.

It is difficult to do justice to the manner in which the monograph is illustrated, for the full descriptions are made even clearer by well-made photographs and roentgenograms. A discussion of each, with findings, is a valuable addition to a description of the positions.

G. F. REDDISH.

BOOKS RECEIVED

PHYSIOTHERAPY: THEORY AND CLINICAL APPLICATION. By Harry Eaton Stewart, M.D., attending specialist in physiotherapy, U. S. Marine Hospitals, New York; Director New Haven School of Physiotherapy. Cloth. Price, $7.50. Pp. 351, with 66 illustrations. New York: Paul B. Hoeber, Inc., 1925.

AN INTRODUCTION TO OBJECTIVE PSYCHOPATHOLOGY. By G. V. Hamilton, M.D., Director of Psychobiological Research, Bureau of Social Hygiene, Inc., New York City. Cloth. Price, $5.00. Pp. 354. St. Louis: The C. V. Mosby Company, 1925.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

GARDNER, BOYD S. The relation of the roentgen ray to the newer methods of extraction. *Radiology*, July, 1925, v, 73–74.

Roentgen-ray examinations of supposedly edentulous areas has brought attention to the large number of roots, unerupted teeth, and residual areas of infection which were left without knowledge to the patient, and usually to the operator. This emphasizes the importance of a change in the methods of extraction. Even with its present refinement the open view operation is still the subject of criticism. The technique employed in the open view operation is copied from successful surgical procedure. Instead of removing the teeth with the soft tissues in place these are first retracted so that the operator may actually examine the alveolar process overlying the teeth in question. Moreover, the operator has an opportunity to shape the remaining alveolar process so that the patient can have a better denture in the shortest time possible. In addition trauma is minimized, adjacent teeth are respected, postoperative pain is lessened, and early repair is hastened.

Those engaged in dental roentgenology are urged the use of the postoperative roentgen-ray examination as a routine procedure because it will greatly improve the technique employed in extracting teeth.

GRANGER, AMEDEE. New device and technic for making radiographs of the mastoids in the Law and in the Arcelin positions. *Radiology*, July, 1925, v, 44–52.

The simplified technique for making roentgenograms of the mastoids in the Law position consists in (1) placing between the cassette covered with the mastoid board and one end of the roentgen table two 13° angle blocks, one inclined toward the opposite end of the table, the other toward one side of the table; (2) the patient lies prone on the table, one arm and hand alongside the body and the other hand by the angle blocks; (3) with the pinna held forward one mastoid region is placed on the cassette, the nose resting firmly on the adjustable fiber slide, the septum and alveola pressed firmly against one side of the U-shaped opening in the vertical position of the mastoid board, the glabella and the supraorbital region against the other side; (4) the tube is focussed so that the central ray is directed toward the mastoid region in contact with the cassette. The entire operation requires much less time than formerly and the result is very satisfactory.

The simplified technique for making roentgenograms in the Arcelin position consists (1) in placing a cassette covered with the mastoid board to the vertical portion of which a small shelf has been previously attached on a 13° angle block inclined toward the end of the roentgen table on which it lies; (2) the patient lies prone, supported on the elbows, with the half of the forehead on the side to be roentgraphed in contact with the cassette, the chin resting on a small pad one inch thick, and the occiput inclined toward the small shelf of the mastoid board until the free edge of the pinna rests against it. This gives the approximate 50° rotation of the head found necessary by Arcelin to cause the superior border of the petrous portion of the temporal bone to line parallel to the cassette. With average care and attention the simplified technique using the mastoid board will yield satisfactory results.

MENNINGER, KARL A. Heredosyphilitic cranial osteoporosis. *Radiology*, June, 1925, iv, 480–491.

An additional criterion of late congenital syphilis is to be found in a certain osseous lesion revealed by roentgenograms of the skull. This is not a new sign nor is it pathognomonic nor constant. Nevertheless this lesion, previously recognized but rarely referred to or utilized, is frequently found in routine skull roentgenograms in neuropsychiatric cases which are definitely or probably heredosyphilitic. It has not been proven that this lesion is never seen in non-syphilitic cases, but this probability is rather low.

The lesion is designated as osteoporosis, but should not be confused with other destructive bone lesions occasionally described by the same name and seen in malignancy and acquired syphilis of the bone. It consists of a diffuse, irregular honeycombing of the bones of the cranial vault; and is due apparently to an irregular destruction or decalcification of the cortex of the bones so that the ridges of cancellous structure chiefly remain. Whether or not it is preceded in formation by a proliferative process cannot be determined from the lesion itself. It is apparently most frequently found in the frontal bone but any or all of the bones of the vault may be involved. In individ-

uals thus affected, involvement of the other bones of the body has never been observed.

A total of 35 cases has been studied in which osteoporosis was reported. Brief abstracts of some of these cases are given comprising several showing the epileptic syndrome, the hypophrenic syndrome, and some neurasthenic and psychotic cases. Other syndromes represented were migraine and dyspituitarism.

All the syndromes in which the lesion has been found are limited in variety and indicate the probability of structural brain or endocrine gland injury. The Wassermann test was rather confusing. It is certain that some unquestionable cases of congenital syphilis give negative Wassermann reactions, and it is likewise true that some such cases give positive reactions without any other indications. In this study therefore a positive Wassermann reaction was considered positive but a negative Wassermann reaction was disregarded. Osteoporosis is not always present in congenital syphilis nor in late heredosyphilis nor even in late heredoneurosyphilis. Experience indicates that it is often associated with late heredoneurosyphilis. Whether it represents a product of syphilitic process *per se* or a dystrophic deficiency resulting from germ plasm injury caused by syphilis, or whether it is merely a stigma of somatic degeneration such as scaphoid scapulae is unknown.

Moore, Sherwood. Myeloid myelomata. *Radiology*, July, 1925, v, 18–33.

Myelogenous tumors, if they be tumors, resemble each other in only one respect, that is, in their inevitably fatal outcome as a result of the gradual destruction of the bone marrow. A report is made of 4 cases, namely, a chloroma of the myeloid type, which is considered a myelocytoma, (2) a case of frank plasma cell type of myeloma, or plasmocytoma, and (3) two others classified with the second group but at the same time differing in several respects. In one case a complete autopsy was done, the findings of which raise the question as to whether or not it was an erythroblastoma.

The example of plasmocytoma reported is the ordinary form of multiple medullary myeloma. It was of the characteristic plasma cell type presenting the usual symptoms. Roentgen examination revealed an extensive pathological process of the bones of the pelvis and thorax. The extremities and skull were uninvolved. The chief characteristic of the process, as shown by the roentgen ray, was the production of ovoid or rounded rarefied areas in the bone. These varied in size, and the larger ones gave to the affected bone the appearance of being expanded from within. The patient complained of much pain in the diseased bones, for which deep roentgen-ray therapy was employed without benefit. A description is also given of a second case occurring in a man aged twenty-seven. In sharp contrast to the first case the pathologic process showed a marked predilection for the long bones, although in both cases the changes observed suggested that they resulted from a similar agency. At autopsy the anatomical diagnosis was multiple myeloma of plasma cell type of long bones, with thinning and destruction of the cortex and fractures of the upper thirds of the left femur and humerus. A histological study of the bone marrow led to the conclusion that the myeloma was of the plasma cell type.

The third case occurred in a male, aged thirty-five, whose examination revealed nothing of importance at first, save that due to the destructive process in the right side of the sacrum and along the sacroiliac joint. The roentgen-ray examination revealed a pathological condition of the right side of the sacrum, upper third of the left tibia, right humerus, bones of the right ankle and foot. The findings were characterized by a rarefaction and destruction of the bone; the outlines of the rarefied areas were not clear-cut and tended to fuse. There was no indication of expansion of the bone nor of periosteal response. This patient received deep roentgen-ray therapy over the bone lesions with astonishing symptomatic benefit. Examination of the bone lesions showed evidence of some repair having taken place, and there was complete relief from pain. A subcutaneous tumor nodule excised from the right abdominal wall was diagnosed as myeloid myeloma of the plasma cell type.

The fourth case occurred in a male, aged twenty-nine. The roentgen examination of the left humerus revealed a block fracture at the midpoint. Radiating out from the shaft of the humerus at this point were numerous calcified arborescent strands, extending into the soft tissues. The roentgen-ray findings of the chest were negative and there were no bone findings elsewhere. The diagnosis was myelogenous leucemia, and the arm was disarticulated at the shoulder in view of the pain and the hopelessness of attempting union of the pathological fracture. Roentgen radiation was applied as a relief measure from time to time with some benefit. The anatomical diagnosis at autopsy was myelogenous leucemia with enlargement of the spleen and liver and hyperplasia of bone marrow; leucemic tumors of femur, rib, vertebrae and ilium, with infiltration of periosteum and involuntary muscles. It is however pointed out that the striking skeletal

changes which this case presented remove it from the classification of myeloid leucemia. This case is unique since its roentgenographic findings are dissimilar to those of any other bone affection. It is believed that the case was actually a chloroma of the myeloid type.

The writer considers that there are four distinct malignant conditions exhibited in these four conditions and that the peculiar histological picture found cannot be explained as a variant of the same process operating in all four and to be ascribed to anaplasia, as suggested by Ewing. The bone changes present differ from each other, and further, they are unlike those observed in other conditions which affect bone. Such cases when observed, should at least suggest the possibility of being of medullary origin. This is important for the reason that being systemic in character it is essential that they be separated from the usual primary tumors of bone, as the treatment is radically different in the two conditions.

ROENTGEN AND RADIUM THERAPY

ALTSCHUL, WALTER. The roentgen treatment of tuberculosis. *Strablentberapie*, 1925, xix, 505–515.

The author has given up the use of artificial sunlight for the treatment of tuberculosis in favor of roentgen rays. The disadvantage of the latter is that the applications are of a local nature rather than general, but roentgen treatment can be combined with heliotherapy very readily. In the treatment of tuberculosis there is no need for the use of a deep therapy apparatus. The dosage is adjusted to the needs of the individual case, small doses with weak filtration being preferred generally. Best results of roentgen therapy are obtained in tuberculous lymphomas of the neck. It was found that even the fistulous lymphomas often cleared up promptly. The mildest reaction was found in closed caseous lymphomas which could never be completely eliminated. It was found advantageous to aspirate pus; and irradiation was then applied about a week later. Very favorable results are obtained in bone and joint tuberculosis when roentgen therapy is combined with orthopedic procedures. The various other types of surgical tuberculosis (peritoneal and adnexal tuberculosis) are a promising field for roentgen therapy, but tuberculosis of the tongue fails to respond to roentgen rays.

Bronchial gland tuberculosis, i.e., the primary complex, is favorably affected by roentgen rays, and especially noteworthy is the disappearance after first irradiation of the symptoms due to pressure on adjacent structures. Hopes for attaining similar results with roentgen therapy in pulmonary tuberculosis cannot for the present time be sustained.

APPELRATH, HANS. Radiation therapy of chronic arthritis. *Strablentberapie*, 1925, xix, 669–678.

Roentgen therapy of chronic arthritis and the residues of acute arthritis is capable of influencing these diseases favorably. The effect consists in an amelioration of pain and improvement of motion. The dose necessary is about 20 per cent of a skin unit dose. An essential in treatment appears to be the uniform distribution of the dose to all portions of the affected joint. For this purpose the embedding procedure seems to be an unavoidable necessity.

With the observance of necessary requirements, the procedure is absolutely harmless and is able to yield results much more rapidly than others. It is emphasized that the treatment does not eliminate the joint changes produced by acute or chronic arthritis. The procedure merely relieves the symptoms and permits the patients to resume their activities.

BARDACHZI, FRANZ. Failures in roentgen therapy and their prevention. *Strablentberapie*, 1925, xix, 613–648.

To prevent the occurrence of errors in treatment, it is of primary importance to outline a definite plan of treatment for each irradiation, making note of all details important for a particular case. Supervision of the plan and its execution must be the duty of the roentgenologist. Conscientious supervision will do away with a lot of factors that lead to errors and overdose. Above all, the physician should see that there is adequate shielding and exact outlining of the field to be irradiated; he should be responsible for adjusting the tube and should satisfy himself that the proper filter has been inserted. Many ingenious devices have been suggested to prevent forgetting the all-important filter, but none of them is fool proof and they all lead to carelessness and negligence. The only sure protection against omission of appropriate filter lies in the conscientious routine checking up before throwing in the switch.

BECK, A. The importance and the problems of radiation therapy in surgery, with especial regard to the experience of the surgical clinic in Kiel. *Strablentberapie*, 1925, xix, 199–260.

Radiation therapy in surgery fulfills a double function. In the first place it competes with the purely surgical procedures, and on the other hand, it augments them when the

limits of surgery have been reached. A general discussion is given of the experience obtained in over 2000 cases comprising various carcinomas, sarcomas, lymphogranulomatosis, Basedow's disease, keloids, prostatic hypertrophy, neuralgia, tuberculosis, bone fractures and nonspecific inflammations. Some practical conclusions are drawn upon the place of radiation therapy in surgery: Carcinomata with a poorly or nonreactive tumor bed (bone, scar, chronic roentgen injury following repeated irradiation of refractory tumors) present in advance a poor prognosis so far as concerns their response to radiation. A further important point is the requirement to avoid everything that might cause a drain upon the local and general reactivity. This means that there is an optimum dose of radiation which if exceeded injures the reactivity of the area.

The various results obtained in the different surgical diseases in which radiation therapy has been applied have, with few exceptions, one thing in common and that is the uncertainty of its outcome. There is a certain empiricism from which we have not yet escaped. Nevertheless it is quite clear that radiation therapy has become an indispensable aid in surgery. Radiation therapy has ceased to be a scheme of treatment for diseases or disease groups in which the dose is the main consideration. It now constitutes a mode of treatment which considers the individual case as a special problem and in which the dosage is controlled under wide limits. This naturally implies that exact physical measurements of dosage cannot be neglected. The same principles that guide in successful surgery hold true for successful radiation therapy. It is important to keep in mind the reactivity, the resistance and the reserve powers of the individual case.

Béclère, M. Postoperative preventive roentgen therapy of carcinoma of the breast. *Strahlentherapie*, 1925, xix, 62–83.

A consideration of the findings in a number of different clinics leads to the conclusion that the postoperative prophylactic roentgen treatment of mammary carcinoma, when administered as a single very intensive irradiation, is dangerous and the relative proportion of recidives resulting is greater rather than smaller. On the other hand, repeated irradiations with moderate doses is safe and apparently effective, at least within the irradiated area, although the effect does not extend beyond the walls of the thorax.

The practical conclusions to be drawn from these findings are: (1) following removal of mammary carcinoma, the administration of an intensive irradiation over the operative field with a cancer-killing dose should be omitted and forbidden as a measure to prevent recurrence; (2) repeated irradiations with moderate doses are to be recommended, because they are harmless and because statistics from German, Dutch and Swedish clinics indicate that favorable results may be expected. The irradiation of the supraclavicular region should not be regarded as a portion of the prophylactic treatment, but rather as an indispensable complement to the operative procedure in all those cases in which the operation does not extend to the axillary region. It is important to maintain the integrity of the skin and distribute the dose over several days, if not over several weeks.

Burnam, Curtis F., and Neill, William, Jr. A brief review of the indications and technical procedures employed by the authors in treatment of cancers of the uterine cervix and body. *Radiology*, July, 1925, v, 1–4.

The treatment of cancer of the cervix must not be considered a closed book but rather as a vital and constantly developing field for further progress. The authors are confident that they are obtaining a higher percentage of cures in the early cases than were obtained a decade ago. They are pushing forward the limits of curability in the more advanced cases which formerly were only palliated. The problem in radiation therapy is to treat so that the cancer receives a large dose and body tissue itself correspondingly little. This is ideally met in epitheliomas limited to the cervix where radium is applied directly to the lesion.

In early cases of cancer of the cervix it would seem that almost as many patients are curable by radiation as by operation. It is not clear what advantage combination of the two methods gives. Operation is fraught with considerable danger and is not to be dissociated from morbidity and an immediate mortality. In early cases, however, if only good operative risks are included the primary death rate should be small. Patients presenting any of the serious organic complications should be irradiated and not operated on. In preoperative radium irradiation, 1 gm. hour is applied in the cervical canal with tubes in tandem from os to os, and 1 gm. hour covering the entire cervix. The best time to operate is within a week of this treatment; preferably the very next day. Postoperative irradiation with radium in these cases, except when vaginal or local pelvic recurrence has taken place, is not believed in. In borderline cases a combination of surgery and radiation is preferable. It is

urgent in these cases to be ready to meet emergency at the time of operation by the implantation of emanation tubes. Where the vaginal wall is extensively involved a flat applicator with 1 gm. radium is given for thirty minutes to each square inch of surface, filtered with 1 mm. brass and 2 mm. rubber. When radium is used alone it is given in a single treatment of 3.5 gm. hours. As a rule the local growth disappears entirely. The single dose is preferred to the broken dose. A second treatment is not to be considered under eight weeks and then only if there is definite new development beyond the site of the original disease. The results in this group are so good that it is a great question whether operation should be combined with radiation or whether it should be reserved after definite extension beyond operable limits has taken place, to facilitate implantation. Wide portal roentgen-ray radiation has not added to the results and the opinion is expressed that it has no proper place in the treatment of these cases except as a palliative for the more advanced types.

In cancer of the body of the uterus the early cases should be relieved by an abdominal hysterectomy unless there is considerable vaginal relaxation when vaginal hysterectomy is advisable. When the patient is old or suffering from some organic disease making operation anesthesia dangerous, intrauterine radiation up to 2.5 gm. hours treating the entire uterine cavity is a curative procedure when the disease is limited to the endometrium. For this purpose use is made of radium emanation, screened with 2 mm. brass and a coating of beeswax, the entire treatment being given at a single sitting. In borderline cases of this group abdominal hysterectomy is strongly advised. Efficient radium application is difficult to estimate and on account of the size of the uterus the mechanical difficulties of a vaginal hysterectomy are often great. If operation is contraindicated intrauterine irradiation of 3 or more gm. hours combined with external through and through treatment has yielded great improvement in patients' health. Such patients may live for years in comfort after this treatment. In advanced cases of this group, treatment should be palliative only. One gram to 2 gram hours combined with moderate external irradiation is given, no attempt being made to irradiate organ metastases in other parts of the body unless they cause pain.

Costolow, William E. Radiation treatment of bone tumors. *Radiology*, July, 1925, v, 37–43.

There has been a tendency to less radical surgical treatment, especially of benign bone tumors and even in malignant cases the field of surgery is limited as metastasis has usually occurred or cannot be prevented by the time a case is first seen.

A preliminary report and analysis is given of 3 of the earlier cases of a series which have been under radiation treatment with definite benefit. The first two cases were probably benign although biopsy was not done. The third case was a spindle cell sarcoma, developing later to a giant cell sarcoma, in a boy aged twelve. The first two cases were treated with copper-filtered, high voltage roentgen rays; while the third case was treated with moderate voltage, aluminum filtered roentgen rays, and buried, lightly filtered radium. In the treatment of bone tumors of the extremities the method of Jüngling is to be recommended. He uses square aluminum boxes which surround the involved area and are filled with fuller's earth or an organic preparation, as radioplastin. This method insures a more homogeneous radiation to all parts by utilizing the scattered radiation. Also four exact portals of entry may be used.

The cases treated are free from symptoms and clinically well, and there has been no evidence of recurrence of the disease. Study shows that the bone growths have been definitely influenced by the radiation, that the disease has been arrested, and there has been a deposit of lime salts and new bone. Not enough work has been done on the radiation treatment of definitely proven bone tumors to draw any conclusions regarding these cases.

Dévé, F. The action of penetrating roentgenotherapy on hydatid elements. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 1184–1185.

A dose of 13,400 R is not sufficient to destroy the vitality of echinococcus cysts. The hydaticide dose, or more exactly the "scolicicide" dose, was found to be about 20,000 R or above. In fact a great number of scolices subjected to this dose succeeded in completing their vesicular metamorphosis and the microhydatides continued in their development for a certain time, approximately one to two months, before showing definite degeneration. In fact some of them continued to live for longer periods, their vitality being only retarded. The use of strong doses in such cases is therefore indicated.

Dautwitz, Fritz. The sensitiveness to radium radiation when roentgen sensitiveness is absent. *Strahlentherapie*, 1925, xix, 153–169.

The fact that there is an occasional clinical finding of radium sensitiveness in cancerous tissue insensitive to roentgen rays has a certain

theoretical interest, but is not of great importance in general practice, because only a small proportion of roentgen insensitive cases are able to react to radium.

A detailed description is given of the clinical course in a fifty-five year old woman suffering from mammary carcinoma. She had undergone an extensive series of roentgen treatments without receiving much benefit, whereas the radium treatment caused a pronounced improvement, despite the fact that the tissues had to a certain extent been injured by the previous administrations of roentgen rays.

FRIED, C. Roentgen treatment of inflammatory pelvic diseases in gynecology. *Strahlentherapie*, 1925, xix, 649-668.

The effect of roentgen rays upon inflammatory conditions seems to be due to certain immunologic reactions produced within the body by the rays. An experiment is cited in which test was made of the blood of a patient suffering from puerperal parametritis. Before irradiation the active serum showed an incomplete bactericidal action against anthrax bacilli, while the inactivated serum showed no action against these organisms. Four to six hours after irradiation the active serum showed complete bactericidal action and there was also a pronounced effect in the inactivated serum. Essentially the same result was observed against *Staphylococcus aureus*. In general, such an increase in bactericidal power of the serum was observed in two-thirds of all the cases studied. Not infrequently, it was observed that the organisms in an infected area completely died out forty-eight hours after irradiation, leaving a sterile pus. It has also been found that local foci contain large quantities of proteolytic ferments which are responsible for rapid digestion and disappearance of the inflammatory focus.

In the present summary of 52 cases, 44 are recorded as having yielded excellent or good results with roentgen treatment, and 8 are listed as poor or bad. The conditions included are acute putrid endometritis, parametritis, salpingitis, and inflammatory "adnexal tumors," pyosalpinx, and hematosalpinx. The clinical features of 14 cases are briefly outlined and discussed. Also, a total of 12 generalized infections (sepsis and peritonitis) were treated as a last resort, and 7 were saved. Cases undergoing roentgen treatment took on the average 13 per cent less time from admission to discharge than did similar patients undergoing the usual medical or surgical treatment. Some of the patients were re-examined one or two years later and the general impression was very good. The average age of all the cases was about twenty-eight years, and in none of those re-examined was there any interruption in the normal menstrual activity.

Radiation was administered with a Lilienfeld tube, 8 ma., 100 kv. effective potential (140 kv. peak) through 0.5 mm. Zn plus 0.5 mm. Al. Where infection was definitely unilateral the corresponding pelvic section was irradiated abdominally through one large field. In bilateral involvement, the whole pelvis was exposed through a single large field. The dose as measured by the incident roentgen energy was 15 per cent—at a maximum 20 per cent of that quantity which produced mild reddening in eight days and browning in three weeks. This corresponds to a dosage of 120 to 160 R. The latter figure should not be exceeded. Most of the recent cases were irradiated at a distance of 50 cm., but in grave cases it may be advisable, in order to reduce the time of irradiation, to apply the dose at a shorter distance (25 cm.). If necessary, the treatment may be repeated after eight days. This repetition is definitely non-injurious and is often successful in producing a result. The author has never given more than two irradiations.

GABRIEL, G. "Preirradiation," a source of error in exact roentgen dosage. *Strahlentherapie*, 1925, xix, 598-600.

Physical and biological investigations show that during the heating up of the tube the skin receives a certain amount of radiation which should be taken into consideration if one is to avoid injuries, and if it is desired to keep close track of the exact dosage of roentgen rays administered.

GROEDEL, F. M., AND LOSSEN, H. Hazards in the roentgen-ray treatment of surgical and skin tuberculosis. *Strahlentherapie*, 1924, xviii, 829-844.

A description and discussion is given of 7 cases, in each of which there resulted roentgen injury following a single irradiation. In 2 cases, the axillary region was the site of injury, in one case the cheek, in another the wrist, in 2 cases the knee, and in one case the leg. Four of the cases had received irradiations by roentgen specialists. Although none of the injuries was fatal, they resulted in long drawn out disability, and necessitated amputations or resection. To all appearances the resulting symptoms were hard to differentiate from those due to a severe roentgen reaction, namely, acute swelling, intense erythema, and tissue breakdown. The presence of very pronounced secretion suggests, however, that intensity of pain in these patients with tuberculous ulcerations was not the pronounced

symptom that it is in other types of roentgen injury. Considered all in all, there appears to be no doubt that there was, in these cases, a hypersensitiveness of tuberculous tissue towards roentgen rays—to call it "idiosyncrasy" is evading the issue.

It is obvious that in the roentgen treatment of surgical and skin tuberculosis a prime essential is the avoidance of injuries to the skin; and this is attained by the choice of a proper filter, and by control of the number of single irradiations, the length of time between irradiations, and, finally, by adequate after-treatment. The skin is best protected by a zinc filter, and aluminum should be used only with the greatest precaution. It seems preferable to administer a few relatively large doses rather than numerous partial doses. The intervals between treatments should be at least six weeks. Following irradiation the skin should be covered with fresh (not rancid) lard.

With suitable roentgen irradiation and after-treatment it is believed that cases of so-called roentgen injury of tuberculous skin or surgical tuberculosis will disappear.

HARMS, CLAUS. Arrested development of the female breast following roentgen irradiation. *Strablentherapie*, 1925, xix, 586–588.

A case is described of a girl who at the age of twelve received roentgen treatment for tuberculosis of the right hilus glands. This treatment consisted of six sittings within six weeks, at each of which 15 to 20 X were administered through 4 mm. Al (Apex apparatus and water cooled tube). At that time development of the breasts was not yet noticeable. Following the treatment there occurred a very pronounced browning of the irradiated skin. Two illustrations are given showing the present condition. The left breast has developed normally while the right is completely absent. The skin of the irradiated area shows pronounced atrophy and telangiectasis. The nipple is decidedly infantile and no gland is palpable. The girl, at eighteen years, is otherwise well developed, and the hilus tuberculosis appears completely cured.

It would seem that because of such possible injuries the irradiation of mammary regions in young girls should be undertaken only with great caution.

LACASSAGNE, A., AND SAMSSONOW, N. The effect of irradiations on grafted cancers and on the local receptivity to the cancerous graft. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 1124–1226.

It is shown that preliminary irradiation of an area of the skin of a rat destined to receive a cancerous graft does not prevent the success of the graft. However, preliminary irradiation, using suitable dose and technique, of a cancer to be grafted into the skin of a rat does prevent the success of the graft. A fibrosarcoma was used in these experiments. Direct irradiation of the tumors before transfer to healthy rats were made as follows: distance from skin to anticathode, 30 cm.; filtered through 5 mm. aluminum; spark, 40 cm.; intensity, 5 ma.; duration, 1 hour; dose, 7,000 R. Success of the graft because of irradiation with the above dose was definitely prevented in most of the animals; only one of them died, and but 2 of the remaining 7 animals gave positive growth from the grafts. Irradiation of cancerous tissue before grafting prevents, usually, success of the graft, but preliminary irradiation of healthy tissue before being grafted does not prevent success of grafting.

MARUM, GOTTLIEB. Results of mild ovarian irradiation in women of procreative age. *Strablentherapie*, 1924, xviii, 849–957.

With suitable technique of irradiation it is possible, in a large majority of cases of hemorrhagic metropathy, myoma and inflammations of the vaginal adnexa to prevent the appearance of not only a permanent amenorrhea, but also the temporary. Proper ovarial irradiation prevents oligomenorrhea, and, at the same time, minimizes, to a large extent, the many disagreeable side effects. Since the treatment is in no sense "temporary castration" or "temporary sterilization" it is suggested that the process be termed "mild ovarian irradiation." The term recommended implies a bilateral irradiation of the ovaries with 20 per cent of a skin unit dose.

The conclusions are based upon the study of a total of 27 cases. Nine out of 14 cases of hemorrhagic metropathy, and 7 out of 11 adnexal inflammations were successfully treated. There were 2 cases of myoma, and one of these responded favorably. The patients varied in age between twenty and forty years. It was observed that patients between twenty and thirty years showed a larger percentage of favorable results as compared with those between thirty and forty years.

The technique of administration was as follows: Symmetrie apparatus, Coolidge tube, 110 volt DC, 2.5 ma., 0.5 mm. Zn + 1.0 mm. Al, 23 cm. skin focal distance, using a Wintz anatomical tube applied abdominally over each ovary. The complete dose was given at one treatment, the duration of which was about twenty-five minutes. In two cases, a repetition of the treatment had to be given fifteen and twenty-one months after the first,

following a pronounced recrudescence of the hemorrhages. In the treatment of adnexal inflammations, the radiation is applied only to the affected side, and the ovary receives about a skin unit dose.

NEMENOW, M. Seminomas and their treatment with roentgen rays. *Strahlentherapie*, 1925, xix, 679–689.

Malignant tumors of the testis and their metastases are among the most radiosensitive of neoplasms. All such tumors should receive roentgen treatment as early as possible, because any other treatment, surgery included, gives no prospects of success. If the primary tumor is present surgical castration must be immediately performed. Whenever a castration is performed, no matter for what reason, a histological examination of the material should be made, and dependence should not be placed upon mere macroscopic inspection. In operation on the ovary where a tumor consisting of embryonal epithelium has to be removed, roentgen therapy must also be instituted regardless of whether or not metastases have been discovered.

In a total of 12 cases observed by the author 5 have been discharged as clinically healed. The technique of roentgen treatment at present employed is as follows: The surface of the abdomen and back is divided into four fields each, and frequently an additional field is taken in the vicinity of the scrotum. The radiation is filtered through 0.5 to 0.8 mm. Cu or 0.5 mm. Zn, each in combination with 1 to 3 mm. Al; each field receives one-fourth to one-third of a skin unit dose. The dose for a single field is frequently divided over two or three days and the whole treatment is repeated after three or four weeks. Two of the cases cited were received in a moribund condition and did not receive roentgen treatment.

Two further cases are cited which illustrate the extreme sensitiveness of the seminomas to roentgen rays. In one of these cases symptoms of acute intoxication occurred which were apparently due to a rapid resorption of the tumor following irradiation. This is a warning of the caution that must be exercised in the treatment of such tumors. Small doses of radiation should be administered over a period of several days.

POHLE, ERNST A. The effect of *x*-rays on callus formation in ununited fractures. A preliminary report. *Radiology*, July, 1925, v, 67–70.

In certain cases of very poor callus formation, one or more exposures to small roentgen-ray doses lead to the healing of the fracture. A report is given of the treatment of 15 cases, 11 of which were clinically healed. The technique used was 160 kv., 4 ma., 0.5 mm. Cu plus 1.0 mm. Al, 5 by 15 cm. field of entry, 50 cm. focal skin distance, 28 ma-min. (about 10 per cent of a skin unit dose).

QUIGLEY, DANIEL T. Etiology, pathology, and treatment of cancer of the cervix. *Radiology*, July, 1925, v, 9–17.

American surgeons operate on many cases which would be rejected as inoperable in Europe. A total of 69 cases were studied belonging to the group that would be considered as operable by the average careful European surgeon. Of this number 51 were traced over three years, and 37 of them have remained apparently cured. The remainder have been lost or died after three years of known good health. These early cases of cancer of the uterus were treated with radium and roentgen rays.

In dealing with cancer of the cervix, the most probable cause is a torn cervix and treatment should be considered from that angle. The torn cervix should be immediately repaired before ulceration and deep seated infection become established. If ulcer of a benign chronic type exists it should be considered precancerous and the cervix should be amputated. If proliferation of tissue has started, as evinced by a hardened edge of new growth showing tendency to bleed, then radium should be used locally followed by operation or not according to the needs of the individual case. In the borderline and advanced cases, radium should be applied for intensive local effect and roentgen rays for extensive effect.

REYN, AXEL. Roentgen and phototherapy of tuberculous lymphoma. *Strahlentherapie*, 1925, xix, 261–284.

Light baths (sun or artificial chemical light, especially carbon arcs) represent one of the best known curative agents for tuberculous lymphomas. The fistulous forms of the disease are best treated with concentrated carbon arc light (Finsen treatment).

Roentgen treatment of such cases should be applied only in such doses that will assure no injury to the patient. As a main method of treatment, it yields much poorer results than treatment with light baths. If it must be used it is preferable to have it combined with the latter. All available therapeutic measures (light, roentgen rays and surgical operation) should be applied in the treatment of tuberculous lymphomas. An individual with this disease must be regarded primarily as one infected with tuberculosis, and should therefore be treated generally and not merely locally;

and in general treatment the use of light baths is of very great value.

SOUTHARD, J. D. *X*-ray treatment of bone tuberculosis. *Radiology*, July, 1925, v, 34–36.

A preliminary report is given of the treatment of 27 cases completed one or more years ago. Six or more of the cases had been operated on twelve times, with little or no permanent improvement, and a large majority of these were of long standing. The average treatment time for the 22 cases cured was a little over four months. The technique was varied according to age and size of the patient and location of the disease. In the average case the cross fire method through as many portals as available was used, delivering one-half to one erythema dose of filtered rays during the first month of treatment. No massive nor lethal dose is needed. The effect of this treatment in spinal tuberculosis has been particularly gratifying. The remaining 5 of the 27 cases are listed as improved.

TAUSSIG, FRED. J. Irradiation in cancer of the cervix. *Radiology*, July, 1925, v, 5–8.

Out of a total of 100 cases of cancer of the cervix treated from 1917 to 1920 inclusive, there are alive and clinically cured at the present time 8 patients. The dosage of radium given depended not so much upon the size of the lesion as upon the general condition of the patient. The average total dose now employed is from 4000 to 4500 mg-hr., at least two-thirds of which is beta radiation with needles or bare silver tubes. The total dosage of radiation is applied within a period of six weeks for best results. When the patient is weak or has nephritis or diabetes only 2000 mg-hr. is given at the first sitting and repeated four weeks later.

Increasing experience has shown how to avoid complications such as sepsis, hemorrhage and fistulae, to a large extent. In a relatively large number of patients there are metastases in the iliac glands without any recurrence in the uterus, vagina or parametrium. The treatment of these metastases has been accomplished by laparotomy and direct implantation of 1 mc. emanation spicules into the gland, the dosage depending on the size and number of the glands involved. It is believed that this mode of treatment is probably only palliative.

MISCELLANEOUS

HOLTHUSEN, H. Dessauer's heat-point hypothesis. *Strahlentherapie*, 1925, xix, 285–306.

The explanation of Dessauer that the heat-point hypothesis remains the only possibility for explaining the effect of roentgen rays is not convincing since there are various observations that conflict with it. It seems more probable that the events occurring in biological material when subjected to radiation might well be coordinated with photochemical effects in general. If it is intended to call the latter heat-points then the question becomes merely one of nomenclature. In the present stage of our knowledge it is important to differentiate between the individual processes taking place rather than to integrate them all under the general subject of energy interchange.

It must be emphasized, however, that the possibility must be admitted that the mode of action in a colloidal system possessing structure runs a different course as compared with the usual photochemical reactions. Nevertheless, observations up to the present do not support this possibility, and thus far the heat-point hypothesis does not have the support of even a single positive observation. Its justification therefore must be denied. The conclusions drawn by Dessauer from his heat-point hypothesis, so far as they have a parallel in heat and radiation injury, are in no sense dependent upon whether or not the heat-point hypothesis has any real existence. The attempt to explain the differences of injury to various cells following roentgen and radium irradiation on the basis of the law of probability does not stand up under a critical analysis.

HOSOKAWA, T. The effect of radium bromide administered intravenously or per os as respects the fixation of radium in the body and the intermediary metabolism. *Strahlentherapie*, 1925, xix, 546–558.

Radium bromide injected intravenously appears to be fixed mainly in the bone marrow and remains there for some time. Significant amounts of radium were found over a month after injection. Further experiments will have to show how long injected radium bromide can be retained in the body. The dose in these experiments was administered either in one injection or in several small injections distributed over a few days. With doses of 30,000 to 80,000 Mache units of radium bromide per kilo the weights of the experimental dogs suffered a pronounced and progressive decrease. Such doses are therefore quite toxic.

One dog weighing 7.5 kilos was fed 330 Mache units daily for 123 days. It was in good health and weighed 6.9 kilos when killed; and autopsy showed no changes in any of the organs. Another dog weighing 11 kilos was fed the same dose daily but died on the thirty-eighth day of an intercurrent pneumonia. In each animal the urine was free of protein and sugar. A slight radioactivity was demonstrable in these urines.

After the intravenous injection of 30,000 to 80,000 Mache units of radium bromide per kilo, either as a single dose or divided in a few repeated injections at small intervals, blood solids of the dog remain unaltered except for slight fluctuations; blood sugar drops somewhat immediately after the injections but returns promptly to the normal level. The rest-nitrogen content of the blood increases somewhat after injection without, however, reaching a critical value, and returns in a short time to normal levels; the chlorine content likewise shows at most only a slight temporary increase.

HUTH, E. Isodoses of various radium and mesothorium preparations and combinations and their application in radiation therapy. *Strahlentherapie*, 1925, xix, 359–382.

An accurate knowledge of the intensity distribution of gamma radiation in radioactive preparations is absolutely essential for accurate dosage in radiation therapy. With the aid of a special device consisting essentially of a small ionization chamber within a water phantom and an efficient and sensitive electrometer the decrease in dose with distance in various directions was determined for the different preparations and combinations. Three different preparations of mesothorium were studied, all of about the same strength and activity corresponding to 35 mg. radium element.

After comparison of the values for the different series of measurements, curves of the decrease in dose with distance were drawn and with their aid isodose curves were constructed. The work demonstrates the great importance of having the containers holding the active salts of uniform size and completely filled. The isodose curves of preparations not uniformly prepared are shown. From the known isodose values for a preparation, it is possible to calculate the values for a combination, and practical examples are given of the application of the isodose curves.

IVEN, HUBERT. Recent investigations upon the effect of roentgen rays upon plants. *Strahlentherapie*, 1925, xix, 413–461.

The many conflicting statements regarding the effects of roentgen rays on plants made it desirable to conduct a critical study using improved physical methods of measurement. The various forms of dosimeter used in older studies were faulty in one way or another. In the present study, it was decided that the best dosimeter is the ionization chamber connected to an electrometer. This yields a purely physical measurement which can be reproduced. A Lilienfeld tube was employed various roentgen effects always occurred after which had been calibrated and found to yield one skin unit dose with 435 R. The radiations tried were: 70 kv., without filter; 60 kv., through 3 mm. Al; 70 kv., through 3 mm. Al; and 90 kv., through 1 mm. Al plus 1 mm. Zn.

The main experimental object was *Vicia faba equina*, and germination and growth were carefully controlled. It was found that the the lapse of a certain latent period, and in none of the experiments was it possible to hinder the early processes of germination by means of the roentgen rays. Moreover, a premature germination was never observed. It is emphasized that the various qualities of radiation tried when of low intensity caused acceleration of growth. The stronger doses were inhibitory, the degree of inhibition being proportional to the applied intensity. In applying a certain dose a threshold of stimulation was attained which could not be exceeded even with increase of the radiation intensity up to the limit used.

Seeds soaked in water proved much more reactive than dried ones. The various experiments cited were performed both in the field and in the green house. In the field experiments, the four different kinds of radiation produced an acceleration in growth at an average intensity of less than one-twentieth of a skin unit dose. Maximum size was attained with one-twentieth to one-tenth of a skin unit dose. When one skin unit dose was applied growth disturbances appeared. When soaked seeds were used, maximum size was produced by radiation lying between $\frac{1}{100}$ and one-twentieth skin unit dose, and inhibition occurred with one-tenth skin unit dose.

As development advanced the roentgen sensitiveness increased. Older seedlings having a root length of 10 cm. and sprout of 3 cm. were less affected by the rays than those whose rootlets had just broken through the seed envelope. Unfiltered, so-called soft rays acted more intensely than did filtered rays. However, the differences in hardness were, in general, insignificant in effect. The inhibition in growth, depending on the quantity of radiation absorbed, was characterized by dwarfing and deformation of the leaves of the main stem, as well as by discoloration of the main root, and reduction of the root branches. Cytological studies disclosed polynucleosis, accumulation of nucleoli in the cell plasm, as well as irregular cell division. The damaged plants never completely caught up in size with the controls. The former remained smaller and weaker in proportion to the intensity of radiation they had received. Nevertheless the injured individuals bloomed at the same time

as the controls and bore normal fruit. Only those seeds receiving the most extreme doses suffered a speedy decline and never developed beyond the seedling stage. It was thought that the radiation might have some effect upon the enzymes occurring during germination. Experiments were performed testing the effect upon diastase, but no effect was demonstrable.

Seeds that had been put away for eight months after irradiation showed upon germination the same effects as those planted immediately after treatment. This observation shows that the primary effect of the rays does not wear off.

The plants grown in the green-house showed themselves to be much more sensitive than those in the field. This is taken to mean that the degree of reaction is dependent upon the general well-being of the whole plant. The phenomena of growth stimulation were evidenced only in an accelerated development which disappeared after ten to twenty days, depending upon external conditions. Therefore the stimulating effect of roentgen rays in minmal doses is only temporary. With decreasing size of the irradiated seeds and fruits there occurred a parallel decrease in radiosensitivity. It appeared that plants with very small seeds exhibited a rather high insensitivity.

JOLLY, J., and FERROUX, R. The action of the roentgen ray on tissues. Diminution of the reaction of a sensitive organ by means of adrenalin. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 125–127.

When adrenalin hydrochloride is injected in a 1 in 1000 saline into the skin directly over lymphatic glands, or even at a distance from them, but in such position that it is carried to the glands, subsequent irradiation of these glands will have but a slight effect upon them. The control glands, on the other hand, will show the usual effect of irradiation, giving the characteristic lesions. The lesions are apparent both to the naked eye and microscopically, and the difference between the control and adrenalin-treated glands is marked. The adrenalin causes constriction of the blood vessels and in this way diminishes the flow of blood and lymph into the glands. The lymphoid tissue has been placed in a state of retarded activity, in which condition it is less sensitive to the action of the irradiations.

KADISCH, E. Experiments on a controlled gradation of dosage in the roentgen therapy of myomas and hemorrhagic metropathies. *Strahlentherapie*, 1925, xix, 462–484.

A total of 327 cases are analyzed statistically according to age, dosage received and degree of amenorrhea produced. The doses, delivered at one sitting, varied from 10 to 80 electrostatic units and the patients varied in age from twenty to fifty-five years. In all cases the aim of the radiation treatment was to produce a permanent amenorrhea, and this succeeded in 246 of the cases. The statistical analysis is concerned with determining the distribution of the failures according to the dose administered. It was found that the number of failures decreased as the size of the dose was increased: between doses of 10 and 40 electrostatic units the decrease was in geometrical ratio, and in doses of 40 to 60 E.S.U. the decrease was proportional to the increase in dose.

KMIETOWICZ, F., and TUMIDAJSKI, J. The activation of proferments by the roentgen ray. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 380–381.

The proferments contained in the pancreatic juice when subjected to the action of the roentgen ray show a definite activation not only *in vivo*, but also *in vitro*. This digestive power is increased for forty-eight hours. There seems to be a process of incubation in the pancreatic juice in which the roentgen rays are being absorbed, for the proferments do not show an increased activation immediately. The work was carried out on dogs in which a permanent pancreatic fistula was made and irradiations made direct. There was at first a diminution of juice, this being followed by an increase in activity.

KEGERREIS, ROY. A portable apparatus for measuring *x*-rays. *Radiology*, June, 1925, iv, 497–499.

An instrument is described in which the working parts are so arranged that reliable readings for tests on roentgen-ray equipment can be made by persons uninformed about the factors which influence the details of its design. Different sized apertures and variations of intensity of target distance are used to adapt the testing outfit to any sort of roentgen tube no matter what its output. The relative absorption of different filters is used to determine the effective wave length or spectral qualities of the rays tested. The entire apparatus is contained within an aluminum cabinet of the shape and size of an ordinary suitcase.

A small D. C. voltmeter with a resistance in series serves to indicate the voltage which is impressed on the system from a 22½ volt "B" battery so that the voltmeter is in circuit at all times while the instrument is being used. Means are provided for testing the current calibration on the microammeter by checking

its sensitivity by that of the voltmeter. The cable which is permanently connected between the ionization chamber and the rest of the apparatus provides flexibility and enables the apparatus to be used with any form of roentgen tube holder or container. The outfit requires absolutely no attention except to note the indication of the microammeter after the roentgen-ray machine controls have been adjusted to the desired settings.

Portable testing units of this type are primarily not for the individual practitioner but for the larger medical institutions, manufacturing, sales, and service organizations.

LORENZ, E., and RAJEWSKY, B. Regarding the designation of roentgen radiations. *Strahlentherapie*, 1925, xix, 349–357.

Statements as to the quality of radiation must be so worded that they are independent of the various conditions of irradiation, refer only to the radiation, are unequivocal and permit the reproduction of the exact radiation at any time. For the definition of ray quality, the coefficient of extinction satisfies these requirements. Its determination requires as a prerequisite the establishment of a filter of biologically practical homogeneity. In the case of pulsating direct current there is also required the determination of λ_0 (or maximum voltage). These requirements are not satisfied by statements of the percentage depth dose or the half-thickness value, for in the latter case the above mentioned corrections are not satisfied.

It has long been recognized that radiation coming through a light filter material does not possess practical homogeneity for a heavier filter material. It is however also true that a practically homogeneous radiation is obtained for light substances by rational filtration through a heavy metal. This forms the basis for a biologically practical homogeneity of radiation.

LÜDIN, MAX. Liver changes following roentgen irradiation. *Strahlentherapie*, 1925, xix, 138–141.

Organs richly supplied with blood and having a high metabolism are regarded as being especially radiosensitive, yet in the case of the liver there is a difference of opinion as to its sensitiveness. To throw light upon this subject, experiments were performed upon guinea pigs and rabbits in which the region of the liver was repeatedly irradiated until death of the animal.

The liver area was irradiated alternately from the front and back with the rest of the body shielded off. The radiation was produced by self-hardening boiling tube, 1.5 ma., hardness 220 sklero (Klingelfuss) skin foca, distance 22 cm. The results obtained with 10 guinea pigs and 2 rabbits showed first of all that unfiltered radiation at high dosage causes death of the animal with symptoms (apathy, cachexia, loss in weight, muscular spasm) which, considered as a whole, suggest the picture of an intoxication. In the livers of guinea pigs succumbing after the second irradiation no histologic alterations could be discovered. The livers of rabbits succumbing after the fourth and sixth heavy irradiations showed essentially normal findings except for hyperemia and a mild fatty degeneration.

The other animals, which were exposed to filtered radiation up to thirty-nine weeks and remained alive, showed relatively slight hepatic changes, thus supporting the opinion that the liver is only slightly radiosensitive. Nevertheless it seems clear that with increased exposure the hepatic changes become more definite, and in addition to vascular dilatation and fatty degeneration there is narrowing of the bile canaliculi, moderate chromatin content of the nuclei, and thickening and lymphocytic infiltration of the Glisson capsules. If the dosage is too high the animals quickly succumb with symptoms of intoxication, thus not permitting time for the development of the hepatic changes. It is only after a long continued mild irradiation extending over many weeks that the early stages of anatomically demonstrable changes in the liver become evident.

LUDEWIG, P. The emanation content of springs in the most important areas of radioactive springs. *Strahlentherapie*, 1925, xix, 170–171.

A list is given of the important radioactive springs in Brambach, Gostein, Joachimsthal, Kreuznach, Oberschlema and Teplitz, together with the activity of each in Eman per liter and in Mache units. Some of the determinations date back to 1911, but the majority of them were made between 1920 and 1924.

PAGNIEZ, PH., COSTE, F., and SOLOMON, I. The action of the roentgen ray on the acid-base equilibrium of the blood. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 489–491.

Using the colorimetric method of Cullen, modified by Guillaumin, the pH of the blood was measured after various doses of roentgen rays. Normal subjects and subjects who had previously been treated with the roentgen ray were used. Some of the subjects were irradiated in the region of the spleen with 500 R; three-fourths of these subjects presented alkalosis one hour after irradiation. The same result was obtained with a subject irradiated in the hepatic region, as well as other subjects treated

on the hand, thorax and below the pubis. In 5 cases irradiated on the triangle of Scarpa, 3 presented alkalosis. Of 15 subjects irradiated in regions removed from the spleen, 11 showed alkalosis, and the remainder either no change or acidosis. Of 30 cases in all so treated, both in the region of the spleen and on other parts of the body, 25 presented alkalosis. The average pH figure reached after irradiation was pH 7.83 to 7.4. The minimum dose necessary to produce alkalosis was 300 and 500 R using rays of medium penetration; the alkalinity usually lasted twenty-four hours.

PALUGYAY, JOSEF. Practical application of the Holzknecht dosimeter for measuring the superficial dose in deep therapy. *Strahlentherapie*, 1925, xix, 172–184.

The use of an integrating dosimeter appears to be indispensable, because even under exact and constant control of the apparatus there is no certain protection against gross over- and underdosage when delivering the radiation for specified intervals. Since there is not as yet available a method for the measurement of the roentgen-ray energy which has been absorbed by tissue, it remains necessary to get along with available dosimeters even though they yield information only as to the superficial dose. The Sabouraud tablet appears to be the only dosimeter which is capable of telling at any moment the total dose administered. Comparative experiments have demonstrated that measuring dosage with the Sabouraud tablet, especially in the form of the Holzknecht dosimeter when a careful technique of administration is followed, gives by far a greater practically demonstrable assurance against over- and underdosage of the skin than does dosage according to time elapsed.

PAULIN, A. The effect of the roentgen ray on the production of antibodies (hemolysin and diphtheria antitoxin). *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 572–573.

Experiments on rabbits showed that irradiations of the whole animal or of certain organs by strong doses of the roentgen ray did not affect the formation of antibodies when antigen was injected. The antibodies against sheep's erythrocytes were formed in rabbits receiving strong doses (50 cm. distance, 40 cm. tension, 4 ma., filtered through 1 mm. Al, duration of 2 hours) in the same amount as in control animals. Strong irradiations of the entire animal or local areas did not destroy *in vivo* antibodies already formed. This was true both in the hemolysin production and the formation of diphtheria antitoxin.

REGAUD, CL., and LACASSAGNE, ANT. Karyokinesis is the period of least resistance of the cell to radiations. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 123–125.

This is a review of the literature regarding the resistance of cells during latent and active periods of their development, and especially during karyokinesis. Some authors consider the stage of karyokinesis as not rendering the cell more sensitive to the roentgen ray, while others seem to prove that it does, that radiosensibility is greatest during cell division. It is conceded that this will vary with the kind of cell irradiated, some cells at this stage being readily destroyed by a weak dose of roentgen ray. Some cells, then, are more sensitive during their period of activity than during the latent period. One of the authors claims that radiosensibility coincides with the period of intense activity on the part of the cell in which the nucleus seems to participate in a particular manner. It seems, then, that the various kinds of cells vary in their radiosensibility according to their activity, some being more sensitive during karyokinesis and others during the latent period.

REISS, P. The stimulation of plant shoots by means of the roentgen ray. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 984–986.

Working with *Syringa vulgaris* the author has shown that application of the roentgen ray does stimulate increase in size of shoots of the plant used, which appears to be growth. As a matter of fact, the increase in length and size is not due to mitotic multiplication of cells, but to increase in size of the cells irradiated. These cells become larger and longer, but not more numerous. Weak doses do not have any effect; the dosage must be as high as 4,000 to 5,000 R before any result is obtained.

ROFFO, A. H., AND CORREA, L. M. The effect of roentgen rays on cholesterin *in vitro*. *Strahlentherapie*, 1925, xix, 541–545.

Using unfiltered soft rays, a decomposition was always produced in cholesterol. The effect ceased at a depth of 10 cm. Cholesterol in a concentration of 0.02 per cent when dissolved in benzol or chloroform is completely decomposed by the radiation after an exposure of at least twenty minutes. It appears that the cholesterin must be in solution for the action to be effective. It is believed that in this decomposition or transformation the turpentine nucleus remains intact and that study of the resulting products will confirm this view. When it is recalled that cholesterin can yield a variety of isomers it seems quite plausible. The results obtained indicate a destruction

of the cholesterol molecule. Moreover, evaporation of the irradiated solution yields an oily, dark green residue of aromatic odor entirely different in properties from cholesterin.

This phenomenon is probably not associated with the oxidizing action of ozone, because no such transformation occurred when a stream of ozone was bubbled through the solutions for an hour. Although the experiments thus far performed were made with solutions contained in hermetically sealed tubes it is nevertheless believed that oxygen played an important part in the decomposition.

ANCEL, P., and VINTEMBERGER, P. The comparative development of the embryo and the blastoderm in eggs subjected to the action of the roentgen ray. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 172–174.

If the roentgen ray in doses varying between 5 and 6 H are applied to the egg of the fowl before the appearance of the embryo, the reaction is always more marked in the embryo than in the blastoderm. This dissociation seems to be complete and distinct. In similar observations on the eggs of the trout the same seems to be true. The dose in the latter experiments was 300 H, and the effects noted were just as marked as in the eggs of the hen.

ANCEL, P. and VINTEMBERGER, P. The radiosensibility of cells in karyokinesis. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 986–988.

Further proof is offered to show that the blastoderm in the egg of the fowl, the cells in mitosis, are not more radiosensitive than cells in the latent period. The lesions produced by the roentgen ray on latent cells in the blastoderm are the same whether the dose is applied at one time or in several doses. The lesions are not greater or different in any way when the cells are in an active state of multiplication.

ROFFO, A. H., AND CORREA, L. M. The effect of roentgen rays on the cholesterin content of carcinomas. *Strablentherapie*, 1924, xviii, 871–877.

It has already been shown that irradiation of the serum of carcinomatous individuals produces changes in the physicochemical constants as well as in the concentrations of certain components. Roentgen rays appear to exert their greatest effects upon the lipoids, especially cholesterol. Examination of sera from cancerous individuals before and after irradiation showed a distinct diminution in the amount of cholesterol which lasted twenty-four hours or longer. The question arises: Is this diminution due to a direct effect upon the high cholesterol content within the tumor, or is it due to an indirect action upon the sources of cholesterol within the body?

The experiments were performed upon white rats maintained upon a strictly comparable dietary. The tumor was a transplantable fusocellular sarcoma. Adequate controls were run by removing a portion of a tumor, suturing the skin and then irradiating the tumor alone or the animal. In one series of experiments, the tumor alone was irradiated, and in the second series, the body was irradiated while the tumor was shielded off.

It was found that within three hours there occurred a diminution in cholesterol to 1 gm. per hundred; and this reduction took place only when the radiation was directed fully upon the tumor mass. The result is entirely the opposite when the body alone is irradiated. These observations reveal (by the destructive action of radiation upon neoplastic tissue) a biochemical process whereby an essential element for the growth and development of protoplasm is removed in the destruction of cholesterol molecules occurring in various combinations.

ANDERSEN, ERNST. Intensification of roentgen effect by oatmeal-sodium chloride diet. *Strablentherapie*, 1924, xviii, 865–870.

The oatmeal-salt mixture is made as follows: 400 to 500 gm. of oatmeal are cooked in about one liter of water or broth, strained through a sieve, and then mixed with 40 to 50 gm. of butter, together with water or broth, as well as salt, according to taste. This quantity is to be consumed during the day in five portions; and with each portion is taken 3 gm. of sodium chloride in wafers. In addition, a patient should receive, morning and evening, a slice of bread and butter, and at midday some cooked meat. The matter of drink is immaterial. After a week of this dieting the first irradiation should be given. Following each treatment the administration of salt water is indicated, to increase the effect. There is one precaution that should be carefully observed; this diet should not be stopped before completion of the course of roentgen treatments, since there would follow an increased calcium concentration resulting in degenerative changes within the tumor.

VON BABARCZY, MARIE. The alteration of blood cholesterin content following deep roentgen therapy. *Strablentherapie*, 1925, xix, 531–540.

Following deep irradiation the cholesterin content increases either directly or following a temporary drop. This alteration in cholesterin content is the resultant of several opposing factors, among which cholesterin mobilization

is important in raising the level. One of the factors responsible for the decrease is probably the increased excretory activity of the liver, whereby bile and cholesterin are eliminated. This factor was demonstrated in irradiated animals.

These observations are based on studies of 9 cases, protocols of which are briefly given. The radiations were administered mainly through 2 mm. of copper and 1 mm. of zinc, 25, 40 and 60 cm. distant.

In the animal experiments the gall-bladder fistula was prepared according to the Pawlow technique, and after healing of the wound the animal was irradiated for thirty minutes. Following this the 24-hour yield of bile was strikingly increased and of a much darker color. Parallel determinations of the blood cholesterin were carried out. The results show that the excreted cholesterin had increased four-fold after irradiation. In other words, the deep irradiation had caused the liver to excrete a greater amount of bile with a greater percentage of cholesterol. After a lapse of a few days the quantity, color and cholesterin of the gall-bladder bile returned to the original values. However, the cholesterin content of the blood remained unaltered after irradiation. Alimentary factors were not operative because the diet was rigidly controlled, consequently the increased cholesterin content of the blood can be explained only as a cholesterin mobilization. It was observed that after the excessive excretion of cholesterin through the bile had ceased the level of blood cholesterin increased to double the value and then dropped back to normal.

Beck, Emil G., and Smith, Elliot. The physiology of a true optical view by means of the stereoscopic radiograph. *Radiology*, July, 1925, v, 60–66.

In many instances the single plate is almost worthless because of the magnification of shadows to the loss of their intensity due to the distance of the objects roentgenographed. Such a single plate may at times lead to false deduction and consequently to wrong treatment. In the stereoscopic picture there is obtained not only the third dimension, but a correction of the magnification and distortion of the shadows. Overlapping shadows representing various dense objects in the path of the rays are separated so as to yield a clear vision of the correct location and depth. An explanation is given of the psychology involved whereby mere shadow pictures can be made to yield plastic images.

If roentgen plates are properly viewed stereoscopically, information can be obtained which is often impossible from a single plate. For instance, in the estimation of the length of a needle embedded in the hand the shadow produced by the needle in the roentgenogram is no criterion of its actual length. The size of the shadow depends entirely upon the angle which the needle makes toward the roentgen-ray plate. When, however, viewed stereoscopically definite information as to the true length is obtained.

Baumeister, L. Technique of measurement in deep therapy. *Strahlentherapie*, 1925, xix, 333–338.

The elements in the calibration and use of the iontoquantimeter are described. The question of deep dosage is a very difficult problem. We possess tables and curves which show the dose distribution from centimeter to centimeter depth for various ray qualities. These values were determined with the aid of the water phantom; but absorption in the human being is not quite the same as in the water phantom because the human body is not quite so homogeneous as is assumed. An experiment is cited in which the depth dose is made to vary quite considerably by the mere interposition of a centimeter or more of air space. Thus, despite very precise measurement of dosage at the surface, the depth dose in the human being is a matter of more or less uncertainty and may be responsible for many faulty results.

Beets, H. N. A projection electroscope for quantitative and qualitative *x*-ray measurements. *Radiology*, June, 1925, iv, 500–501.

The electroscope designed by Elsey of the University of Kansas is described. It is portable, easily operated, and accurate; and the calibration can be checked by the roentgenologist against radium as a standard. It has the further advantage that the image of the indicator and scale can be projected to any reasonable distance in a lighted room. It may be readily inserted in the place of the slide carrier of the ordinary projection lantern.

There are accessory attachments; one a cable and Friedrich tube ionization chamber, and the other a wall-less parallel plate ionization chamber. The cable and small chamber are satisfactory for routine checks and for measurements of radiation quality. The wall-less chamber is preferable for absolute measurements of roentgen-ray output as it eliminates the filtering action and secondary electron effect of the walls of the small cylindrical Friedrich chamber. The calibration of the electroscope in terms of the electrostatic unit and the calculation of the effective wave length is made as with any electroscope.

BRUYNOGHE, R. The action of radium on vaccine. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 1110–1112.

Two samples of different vaccines were placed in the apparatus of Mund, 0.5 c.c. of each dilution mixed with 6 to 7 mc. of radium. After varying time periods, equal quantities of irradiated and untreated vaccines were placed on the cornea of the eye of rabbits and on the shaved skin. No reactions whatever followed the use of irradiated vaccines, no keratitis nor cutaneous eruptions which followed the use of untreated vaccine. In every case, the irradiations destroyed the vaccine so that it would not react as it does when not subjected to radium.

BRUYNOGHE, R., AND DUBOIS, A. The action of radium on trypanosomes *in vitro*. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 213–215.

It is shown that the gamma and beta rays act directly on the trypanosomes and especially on the constituents predominating during their division. *Tr. gambiense* and *Tr. brucei ugandae* were used.

BRUYNOGHE, R., AND DUBOIS, A. The action of radium on *Treponema duttoni*, *in vitro*. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 466.

Radium in platinum cells 0.2 mm. in thickness, 2 mg. of radium per tube, has no effect on the motility or the infective power of the treponema after seven hours, and only a feeble effect after twenty-three hours. When 4 mg. are employed for 22½ hours, there is a noticeable retardation of movement for four days; when the radium is used for forty-seven hours, the retardation lasts for eight days. However, motility does not furnish a definite correlation with infective power. The radon emanations (5 mc.) for five and twenty-three hours renders the *Treponema duttoni* noninfectious as well as nonmotile. The emanations have the maximum action, the gamma and beta rays being only feebly effective.

BRUYNOGHE, R., AND DUBOIS, A. The action of radio active deposits on infection by *Trypanosoma ugandae* in the rabbit. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 752–753.

A fatal dose of radioactive substances on *Trypanosoma ugandae*, as determined *in vitro*, has no effect on the progress of infection in the rabbit by this organism when treated *in vivo*. The slight retardation observed in the mouse is perhaps due to the inhibition of reproduction of the trypanosomes in the circulation, but this is practically insignificant. The radioactive substance injected was a small quantity of NaCl in contact with one closed emanation; the NaCl in physiologic solution is injected with the radioactive element adhering, injection being in the vein. The dose was ± 20 millicuries.

BRUYNOGHE, R., AND MUND, W. The action of radium on bacteria. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 211–213.

It is generally conceded that radium exerts a definite bactericidal action against many species of microorganisms. The gamma rays have no such properties, but the alpha and beta rays are definitely germicidal. In the present paper, the effect of emanations on cultures of certain bacteria was studied. One c.c. of a 24-hour broth culture of *B. pyocyaneus*, *B. typhosus*, *B. coli*, *V. cholerae*, *B. paratyphosus*, *B. subtilis*, *B. anthracis* and others was placed in an apparatus with a capillary tube containing 5 to 6 mc. emanation, and the apparatus sealed. The capillary tube was then broken by means of a small ball in the container, allowing the emanation to spread throughout the culture. Inoculations were then made onto agar slants from the treated cultures at the end of 24 and 48 hours. A microscopic examination (hanging drop) was also made at these periods. After 48 hours' exposure to the emanation, some of the organisms were affected to the extent that they would not multiply; these organisms were *B. pyocyaneus*, *B. typhosus*, *B. coli* and *V. cholerae*. The others were not effected, and their motility was not even altered. Some of the strains did not lose their power of motility, even though they lost their ability to multiply; this is especially true in the case of *B. pyocyaneus*. When the emanation acted but 24 hours, the ability to multiply was not affected. The rapidity of growth is affected, however. The emanations affect only the ability of the organisms to divide, and do not influence other manifestations of vitality, including motility.

BRUYNOGHE, R., AND MUND, W. Irradiated microorganisms and the bacteriophage. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 464–465.

Radium does not noticeably affect the lytic principle called the bacteriophage, even after three days in contact with 7 to 8 millicuries of emanation. Multiplication and the other essential properties of the bacteriophage remain unchanged. *Bacillus typhosus* and its bacteriophage were tested in the same way, 7 to 8 mc. emanation being applied for fifty-six hours. At first the motility continued, but after six days the typhoid bacilli became non-motile, and were by this time killed. During this

time, the bacteriophage was affected to the extent that its host, the typhoid bacillus, was being gradually destroyed, and it, too, disappeared with it. This proves in another way that the host microorganisms must be present in order that the bacteriophage live and continue to multiply. That is, when the host (*Bacillus typhosus*) was destroyed by the irradiations the bacteriophage was automatically eliminated, not due to the effects of the emanations directly, but indirectly because its host was destroyed and its means of existence removed.

CHANTRAINE, HEINRICH, AND MARUN, GOTTLIEB. Constant voltage machine and the Siemens measuring device. *Strablentherapie*, 1925, xix, 339–348.

With uniform ray density the Siemens meter yields uniform results. The depth doses calculated from calibration of this instrument were found to be accurate for low ray densities. With high outputs the calculations of radiation density from the accompanying tables are too low, and consequently the calculated depth doses are too high. If, however, one calibrates the instrument for different distances of the roentgen tube and the corresponding outputs one can obtain accurate readings. Under such conditions the Siemens meter may be regarded as capable of yielding reliable results.

The new constant voltage machines produce with the same voltage no appreciably harder radiation than earlier machines run with pulsating current.

FERNAU, A. On the mechanism of the action of radiation in tissue. *Strablentherapie*, 1925, xix, 142–148.

Despite all efforts, we still possess no exact knowledge of the mechanism of the effects of radiation. We may only record or assume: ionization followed by the appearance of local electrical currents; increase in the hydrogen ion concentration; alteration in osmotic pressure, in vascular and cell wall permeability; change of the disperse phases and of the electrical charge of the body colloids; loosening of proteolipoid complexes; change in state of serum albumin; oxidation and other chemical processes. These effects combined are supposed to account for the effect of radiation upon tissue and blood. The purely mechanistic explanation of the effect of radiation upon the living cell leaves us, as in other biological problems, unsatisfied even though the laws of physics, chemistry and colloids be considered applicable.

FERNAU, A. The absorption of β and γ rays of radium in bone and ivory. *Strablentherapie*, 1925, xix, 149–152.

Dentine and ivory, although they possess different structures, have approximately the same density and chemical composition as bone. Moreover plane parallel sections of ivory can be prepared of any desired thickness so that the absorption of radium radiation may be accurately determined. Such measurements were made upon the beta and gamma radiation of radium in a manner similar to that used by Fernau and Nishikawa in 1919. A change in the thickness of ivory from 0 to 18 mm. corresponds to a logarithmic decrease in absorption of the gamma rays of 0.073. Accordingly a decrease of 0.301 ($\log_2$) corresponds to a half thickness value of 74 mm. According to Lenard's law the absorption is approximately proportional to the density, consequently the absorption coefficient μ for ivory for density 1.9 may be calculated from the known coefficient μ for Al. $\mu\beta$ in Al equals 13.1; $\mu\beta$ in ivory equals 9.2; $\mu\gamma$ in Al equals 0.51; $\mu\gamma$ in ivory equals 0.36.

The curves indicate that beginning with 5 mm. thickness the logarithmic curve becomes a straight line showing the appearance of the more homogeneous gamma radiation and a practically complete absorption of the beta radiation.

GELLER, FR. CHR. The effect of mild irradiation of the ovaries based upon animal experiments. A contribution to the problem of stimulative irradiation of the ovaries and of temporary sterilization. *Strablentherapie*, 1925, xix, 22–61.

An answer was sought to the question: Does there occur a stimulation of ovarian function, direct or indirect, following mild irradiations? The experimental animals used were immature female rabbits and in one case, rats. Usually two sisters from the same litter were used, one serving as a control. The development of the animals was followed for various lengths of time after irradiation and the growth and increase in weight noted. On the same day the experimental and control animals were laparotomized, the internal genitals inspected and one ovary extirpated. Later on the animals were killed and sectioned. Histologic examinations were made of the ovaries, uteri and in some cases, of the hypophyses. The normal variations occurring between sisters in the same litter were kept in mind in these studies. The irradiation was furnished by a Veifa apparatus, Coolidge tube, 2 ma., 190 kv., 0.8 mm. Cu plus 1 mm. Al, focal skin distance, 40 cm., portal of entry 5 by 7 cm. directly over the spine.

As compared with the ovary of the control, the ovary of the irradiated animal usually showed degeneration of the follicular apparatus which was recognizable quantitatively but not qualitatively from that occurring under normal physiological conditions. The first sign of degeneration occurs always in the ovum, often long before the granulosa cells show changes. The ova of the primary follicles show the degenerative changes most pronouncedly in the nucleus which loses its round shape and owing to irregular chromatin distribution is occasionally darker, more often faintly stained and finally disappears completely. The flat epithelial cells of such follicles atrophy and eventually become detached. The ova of the larger follicles lose their round shape, the fine net-like protoplasm stains more intensely with eosin, becomes stringy and often contracts away from the zona pellucida which finally disappears. Frequently the egg cell changes to a homogeneous hyaline ball but here also the nuclear changes are the same as those in young ova. The granulosa of the larger follicles degenerate in the form of nuclear breakdown, casting off of the degenerated granulosa cells into the interior, invasion of leucocytes and swelling of the theca interna. There next follows either a contraction of the follicular cavity caused by the swelling of the theca interna thus showing for a long time in the center of the interstitial gland the degenerated ovum, or else there is a cystic degeneration of the ollicle.

Eleven different experiments were performed and the results may be summarized as follows: Ovaries receiving 5 per cent of a skin unit dose showed no alterations whatever as compared with the controls. Those receiving 10 per cent of a skin unit dose showed a diminution and extensive degeneration of the primary follicles. However follicles of riper stages are in such animals not distinguishable from those in the control animals. Ovaries receiving 20 to 30 per cent of a skin unit dose were mostly smaller than those in the control and were characterized by increased follicular atresia which affected the various follicular stages to approximately the same degree. The primary follicles were greatly reduced in all cases very soon after irradiation and only a few of these survived—mostly degenerative forms. On the other hand, especially in the first few weeks following irradiation, most of the cases showed a numerical increase in young ripening follicles, but even these in numerous cases possessed degenerative characters. Throughout in the control and experimental animal the interstitial gland developed uniformly.

The uterus after irradiation of the ovaries and the uterus cells after isolated irradiation with 5 to 10 per cent skin unit dose showed no alterations. On the other hand, after irradiation with 20 to 30 per cent skin unit dose there occurred a distinct hypertrophy, especially of the mucosa with more or less pronounced extensive decidual reaction. When the ovaries alone were irradiated this hypertrophy of the uterus did not occur. As to a possible effect upon the general development of the animals by mild irradiation of the ovaries there could be observed no response occurring uniformly in all the experimental animals. Nevertheless it is to be noted that in about 75 per cent of the irradiated animals there was an acceleration in the increase in weight and a retardation in the increase in length. Alterations in the secondary sex characters as a result of the irradiation were not observed. Likewise the hypophysis showed no histological changes referable to the roentgen treatment.

These results, critically considered, indicate that in no case could a radio-stimulatory effect be definitely demonstrated in the histological picture of the ovaries, although one might imagine that the frequently observed increase in young ripening follicles within the irradiated ovaries was the result of a radio-stimulation upon certain primary follicles. So far as the main question is concerned it may be said that even very small doses of radiation (as compared with the castration dose) cause no acceleration of ovarian function but do apparently stimulate the uterus directly. It must however be distinctly emphasized that these experiments do not show that there does not exist a stimulatory effect of roentgen rays upon the ovary—only that in the rabbit this stimulation could not be found within the dosage limits administered.

GOECKE. Cure of roentgen burn with solarson. *Strablentberapie*, 1924, xviii, 878–879.

Brief reports are given of 2 cases occurring in women. In each case there was a pronounced burn accompanied by painful symptoms. All the usual wound treatments were without result. Solarson was injected because the patients were losing in strength; and following the injections the burns cleared up without further difficulty.

HEROLD, KARL. The problem of blood sugar regulation following roentgen treatment. *Strablentberapie*, 1925, xix, 516–530.

A study was made of 24 cases that had received either a castration dose or a carinoma dose of roentgen rays. Blood sugar determinations were made by means of the Bang micro method in duplicate or triplicate. The limits of error were between 5 and 6 per cent—mostly

much less. Simultaneous determinations were also made of the total leucocyte number.

It was found that the greatest jump in blood sugar content was coincident with a drop in the number of lymphocytes or followed the latter by one day. However, some of the observations showed a drop in the lymphocytes coincident with a drop in the blood sugar or else the sugar level remained constant while the lymphocytes decreased. In other words, there was no constant relationship between the decrease in lymphocytes and the blood sugar level.

It appears that blood sugar decrease or increase occurring immediately after irradiation, apart from individual characteristics, is dependent upon the type and quantity of the radiation administered. Most of the decreases occurred in cases receiving a carcinoma dose. In order to determine whether the decrease following irradiation is due to an irritation of the parasympathetics tests were made upon a number of patients before and after irradiation following injection of adrenalin (0.05 mg. intravenously). The results confirmed the hypothesis, because the blood sugar curve did not rise to such a high level after irradiation, although all the results were not perfectly definite on this point. Some of the patients received injections of 50 c.c. of a 5.5 per cent glucose solution and subsequent determinations of the blood sugar confirmed the assumption that irritation of the parasympathetics induces activity in the glycogen synthesizing process.

HOLTHUSEN, H. The choice of a unit of measurement in roentgen dosimetry. *Strahlentherapie*, 1925, xix, 185–192.

Measurements of ionization of air are not free from objection because they are dependent upon the nature of the material of the wall of the ionization chamber, and upon the strength and permeability of the wall. For these reasons Solomon has concluded that the electrostatic unit does not represent a useful standard of measurement in roentgen dosimetry. This worker selected as a unit the quantity of roentgen rays, R, (Röntgen) which produces in an ionometer the same amount of ionization that one gram of radium element does at a distance of 2 cm. from a measuring chamber, when placed along the axis of the chamber and filtered through 0.5 mm. platinum. However, the work of Behnken showed for the first time that the electrostatic unit previously suggested can be readily and accurately measured with the aid of a pressure chamber. The unit suggested by Behnken and termed R (Röntgen) is defined as follows:

The absolute unit of roentgen-ray dose is produced by that quantity of roentgen-ray energy which in traversing 1 c.c. of air at 18°C. and 760 mm. pressure of mercury produces a conductivity of such intensity (with complete utilization of the electrons formed in the air and with elimination of effects of the surroundings walls) that the quantity of electricity measured with a saturation current equals one electrostatic unit. A comparison of the new electrostatic unit R with former definitions of the same unit shows that the early errors have been avoided. A useful point is the fact that radium preparations are relatively constant in their output and represent an ideal standard for the calibration of dosimeters. On the other hand, it must be remembered that roentgen rays comprise a group of radiations not idential with the alpha, beta and gamma rays of radium. Hence standardizations of roentgen dosimeters with radium have to be carefully made and carefully interpreted.

SAMSSONOW, N. The best conditions for sterilizing grafted sarcoma on a rat by means of the roentgen ray. *Compt. rend. Soc. de biol., Par.*, 1925, xcii, 575–577.

A dose of 5580 R in one treatment caused, perhaps, the sterilization of a grafted sarcoma. The animal died from ulceration of the skin before the beginning of the regression of the tumor. However, a weaker dose (54.5 H) given in three treatments, given on three consecutive days, with a weaker intensity, caused complete sterility of the sarcoma without lesions of the skin and with survival of the animal. Prolonged irradiation with weaker doses is better than short treatments with stronger doses. The desired result is obtained with the weaker doses and there is no danger.

SCHWARZ, GOTTWALD. The roentgen reaction of the skin. II. The degree of dependence of skin injury upon the intensity of radiation, dosage being equal. The concept of the injury quotient. *Strahlentherapie*, 1924, xviii, 845–848.

A definite difference was observed in the abdominal skin of the same person between areas intensely irradiated for a short time and weakly irradiated for a long time. A four-fold increase of intensity (duration one quarter), caused a fairly strong skin reaction, namely, the appearance of the second and third Mieschers waves, whereas these waves never appeared in the areas irradiated with an intensity of one quarter continued four times as long.

The therapeutic result is believed to be dependent upon the injury quotient, which is defined as the ratio of injury of tumor tissue

to injury of normal tissue. This quotient varies with intensity of the radiation applied, and must be determined empirically. It seems clear that for the human skin intensity increase of one to four, dosage being equal, produces a definite increase in the injury quotient, contrary to current belief that no such change is produced, even with the intensity increased one to eight.

The above conclusions are based upon experiments conducted with Symmetrie apparatus RGS, Coolidge tube, 38 cm. parallel spark gap, 3 mm. Al, secondary current, 3 ma. The intensities were measured with a Sabouraud-Holzknecht instrument.

SCHWARZ, GOTTWALD. The repeated small dose and its biological basis. *Strablentherapie*, 1925, xix, 325–332.

It seems quite possible that within the same structure one cell group may be more sensitive than another, depending upon the metabolism and stage of cell division. As yet we do not possess the means for recognizing an optimal time for irradiation. It therefore does not seem logical to administer single maximal doses at long intervals since the favorable moment may occur during the pauses. On the contrary, a preferable method would be one of continued irradiation in which relatively small, yet effective doses are given daily. With the aid of modern technique in filtering and the selection of various portals of entry, it becomes possible to extend the period of irradiation to an extraordinary degree.

The relation of radiosensitiveness to stage of metabolism and cell division is already well known. It is primarily during the prophase of mitosis that this sensitivity is especially great. What is overlooked mostly, however, is the fact that cells in the same stage of nuclear division and during the resting period of a cell division show differences in sensitivity that are much wider than those between mitosing and nonmitosing cells. Since in cell division only a single phase of growth is considered to be operating and since growth as a whole, just as mitosis, is accompanied by continual alteration of biochemical constitution, it must be concluded that these variations constitute merely a special case of the fluctuating variability of all living cells.

In addition to the above, there is still another factor to be considered. The therapeutic effect is always the result of the tumor destruction on the one hand, and of the reparative vascular and connective tissue development (epithelialization) on the other. All of the factors combined produce an increased tumor destruction and under certain circumstances an increase in the selective effect of the radiation under protracted fractional dosage. There are, however, numerous other conditions which affect the radiation sensitiveness of tumors, many of them important and apparently completely independent of the dosage. For instance, the chemical characteristics of the tumor may play a part. Thus, malignant tumors producing much keratin or melanin are usually only slightly radiosensitive, and it appears to be no mere accident that both keratin and melanin also happen to be among the most chemically resistant of the biocolloids. Moreover, other factors such as the individuality of the patient and nature of the tissue and locality of the disease all play their part.

SIEDAMGROTZKY, KURT. The behavior of the skin capillaries in a roentgen irradiated area. *Strablentherapie*, 1925, xix, 84–123.

The behavior of the capillary elements in the skin was observed in a large number of adult patients suffering from a variety of diseases. The capillary contraction was studied with the aid of adrenalin injections, and capillary dilatation with mustard oil or caffein. The results obtained and observations made refer entirely to adults, some of them of advanced age. There was little opportunity to observe children. In the few cases coming under observation, children were found to show the same responses of the skin capillaries as adults, however, not with the same distinctness or uniformity. This would seem to indicate that the vascular system of the child's skin possesses a decidedly greater ability to repair roentgen-ray injuries; although according to present observations the juvenile and indeed any other blood-rich skin possesses a greater sensitiveness to roentgen rays than the adult's skin. The detailed observations following first and second irradiations with skin unit dose are given for 63 different cases.

A study of the ability of the skin capillaries to constrict and dilate after a single irradiation gives the following picture of the course of the roentgen erythema. On the second day, at the time when a reaction, even the slightest reddening is still unobservable, there is already found a decided hypersensitiveness toward adrenalin. The ability of the capillaries to constrict is distinctly increased. The ability to dilate is also increased but not to the same degree. On the sixth day the ability to dilate is not much greater than that of a normal skin, whereas the power to constrict still remains very high. On the following days (eighth and ninth) there is an increased reddening and a still more pronounced power to constrict,

while the dilatation remains not much different from normal.

The characteristics of the skin capillaries which had been subjected to irradiation a long time previously were made the subject of an extensive study. It was found that such capillaries, even after the administration of but a single skin unit dose or less suffered a pronounced injury to their constricting and dilating powers. Since both these properties are closely related to the presence of contractile elements (Rouget cells), it therefore follows that these cells are robbed by the roentgen rays of their ability to alter their tonus when subjected to external stimuli. This injury is not one of the nervous apparatus, and occurs within these cells and not in their surroundings. The findings of this investigation may be summarized as follows: Exposure of the skin to one skin unit dose, or even less, causes a decided injury to the capillary system of the skin whereby the contractility and permeability are altered. At first there occurs an increase in the contractility, but after the appearance of pigmentation, the power to contract and dilate are decreased. This decrease endures long after disappearance of the pigmentation and is demonstrable years later. The phenomenon depends upon a direct injury of the contractile elements (Rouget cells) in the capillary walls. The permeability of the capillary wall also is affected. At first there occurs an increase which is followed by a decrease in permeability due to injury of the capillary endothelial cells. These phenomena taken together offer the basis for an explanation of the late changes occurring in other organs besides the skin.

Spiegler, Gottfried. Semithickness value and filter equivalents. *Strablentherapie*, 1925, xix, 594-597.

Roentgen pictures taken with soft rays show great differences between tissue and air; in other words, the radiation is differently absorbed by different bodies. The softer the radiation, the finer is the differentiation it shows of the different tissues. This is not the case, of course, with hard rays, and the harder the radiation, the smaller is the equivalent filter thickness corresponding to one millimeter of copper. An example is cited in which when hard rays are used the filtration of copper is ten times that of aluminum, whereas with soft rays it is twenty times. In other words, the relation of copper to aluminum absorption is not invariant but depends upon the wave length. It is also pointed out that with hard radiation the first millimeter of copper exerts a greater absorption than does the second, and so on.

It is generally assumed in the literature that there is a definite and constant relationship between the absorptions of copper and aluminum and it is urged that the real state of affairs be realized. The effective wave length is a much better criterion. This is understood as the wave length which suffers the same absorption as the mixed roentgen beam, i.e., that wave length which possesses the same penetrative effect. Thus, with light aluminum filtration, the effective wave length at 80 to 100 kv. is about 0.22 to 0.28 A., and at 200 kv. with 0.5 mm. Cu, about 0.16 A. It is pointed out that equivalent thicknesses of aluminum and copper are equivalent only with respect to intensity but the radiations that result may not be equivalent in other respects.

Withers, Sanford. Points of interest in the operation of oil-immersed Coolidge tubes at 200 K.V. *Radiology*, June, 1925, iv, 502–509.

Attention is again directed to a method of immersing Coolidge tubes in oil for purposes of economy in operation and general safety. The method offers safety and protection for patient and operator from primary roentgen rays, noise, high tension lines and ionized air. Such an installation is convenient and economical because it is unnecessary to clean the tube or its container, obviates the use of a fan or blower to cool the tube, and there is less chance of breaking the tube through handling and less likelihood of the development of strains in the glass through heating and cooling and improper connections at the terminal.